born on the 5th of November, 1892. was at school at Eton and took his de- at Oxford in 1914. He was twice nded in the War. In 1922 he became William Dunn Reader in Bio-Chem- at Cambridge, and ten years later a low of the Royal Society. His short y *Daedalus* (on Science and the Fu-) had a phenomenal success and showed as a very daring and original thinker; his experimental work has been of a ational sort.

RNOLD LUNN, son of Sir Henry Lunn, born in Madras, 1888. He was edu- d at Harrow (where he lost most of religion) and Oxford. He has been an ovator in more spheres than one. His el *The Harrovians* was the first chal- ge in fiction to the English public school it. He completely transformed Euro- n ski-racing by the introduction of nhill and slalom racing in international mpionships. Before his entry into the holic Church in 1933, he had written *n Wesley, Roman Converts, The Flight n Reason,* and two controversial cor- ondences—*Difficulties* (with Father nald Knox), *Is Christianity True?* (with E. M. Joad): these books mark a steady gress of thought towards Catholicism. ce his conversion he has written *Now I* and *A Saint in the Slave Trade.* The sent work was begun before, and com- ed after, his conversion.

the death; and it is only in els to the death that there is doubt about who won. In present instance, we fancy t those who hold the Hal- ne view at the beginning will ld it at the end; and Lunns- n will be Lunnsmen still. But h sort of reader will have rnt an immense amount about other view: the Materialist the Theist will be a better terialist and a better Theist knowing what is to be said the view he rejects. And if ry reader feels that he could self have made a better job answering Haldane (or n) than Lunn (or Haldane) made, the delusion will not en his enjoyment.

ARNOLD LUNN has also written

PETER CLAVER. A Saint in the Slave Trade
NOW I SEE
ROMAN CONVERTS
THE FLIGHT FROM REASON
JOHN WESLEY
THE HARROVIANS
THINGS THAT HAVE PUZZLED ME
THE MOUNTAINS OF YOUTH
etc., etc.

With C. E. M. JOAD

IS CHRISTIANITY TRUE?

With the REV. R. A. KNOX

DIFFICULTIES

J. B. S. HALDANE has also written

ANIMAL BIOLOGY
CALLICINUS
DAEDALUS
ENZYMES
POSSIBLE WORLDS
SCIENCE AND ETHICS
THE CAUSES OF EVOLUTION
FACT AND FAITH
etc., etc.

THE SAINT MARY COLLEGE
LEAVENWORTH KANSAS

SCIENCE AND THE SUPERNATURAL

A CORRESPONDENCE BETWEEN

ARNOLD LUNN

AND

J. B. S. HALDANE

F.R.S.

Professor of Genetics, University College
University of London

NEW YORK

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I.

PRELUDE TO BATTLE

The Albany Hotel,
Hastings.
October 15, 1931.

Dear Haldane,

It has always seemed to me a pity that the Christians and anti-Christians so seldom engage in battle on the same ground. You inform the listening world through the medium of the B.B.C. that the "creeds are full of obsolete science" and that Christianity is dead, and the following Sunday a parson preaches a sermon on the wireless. The devout don't listen-in to you, or the undevout to the parson.

You, I suppose, believe that your creed if generally adopted would increase the sum total of human happiness, and you would, I suppose, view with alarm any possibility of Christianity regaining its mediaeval hold on the human mind. But doubtless you consider that prospect remote.

Now I have often wondered whether the kind of creed which you preach through the medium of the B.B.C. is ever intended to be anything more than the eclectic creed of a select minority of clever men with interesting work and interesting lives. Are you, in other words, in the least interested in converting the world to your point of view? I suspect not. Are you prepared to take real trouble to reach the unconverted, the victims of superstition? If you are, the proposal which I shall put forward will appeal to you. If, on the other hand, you are not quite so confident about your own philosophy as you would wish to be, and far from confident that it would prove of any value to the mass of your countrymen, you will refuse. Also you are a busy man and will be entitled to decline on that ground.

Briefly, I suggest that you and I should collaborate in a book to consist in a series of informal letters in which you would defend your creed and attack mine and in which I should defend mine and attack yours. The advantage of this scheme is that you would reach the people that read my books, and I should reach the public that read your books.

A book of this kind is rather fun. It is less formidable than sitting down to write a book by oneself. One dashes off a letter, and one is stimulated to continue by the other chap's reply. It is rather like playing correspondence chess.

I can speak with experience, because I have just completed a book of this type with Ronald Knox on Roman Catholicism. May I quote a passage from Knox's last letter? "I am grateful to you for the spirit and vigour of your attack. It is very hard for the Catholic apologist to find a battle-ground where straight issues are to be fought; his opponents, that is those who count, are usually content with a sneer here, an undocumented charge there, in the course of some treatise which has nothing ostensibly to do with religion; they do not trail their coats as of old." And this is true of Christianity in general. It is very difficult for a Christian to persuade his opponents to meet him in open battle.

But though I am far from sanguine, I have a faint hope that this challenge may appeal to your combative instincts.

Yours sincerely,

ARNOLD LUNN.

II.

SCEPTICISM

October 21, 1931.

DEAR LUNN,

Your challenge displayed, I suspect, a considerable insight into my psychology. If you had said that I wrote or spoke unreasonably, ignorantly, or in bad faith, I should have been mildly amused and annoyed. But you wonder whether my creed is "intended to be anything more than the eclectic creed of a select minority of men with interesting work and interesting lives."

Now I happen to regard it as likely that the present rather alarming condition of the human race is largely due to the fact that at present my creed (I object to this word, but we can thrash that out later) is only the creed of a minority, select perhaps, but with little direct influence on human affairs. The whole human race is affected by applied science. Only a very few of them even realize the nature of scientific thought. Much less do they practise it. I find it difficult to believe that the type of thinking which has given us so much power over nature would not enable us to solve a great many of our human problems. Perhaps you will induce me to alter my opinion.

I will go further, and say that in my opinion a society in which a creed was held by a "select" minority, and kept from the vulgar herd, would inevitably become increasingly hypocritical, and probably grossly unjust. Here I am on less solid ground, and perhaps merely rationalizing my emotions.

When, in the same paragraph, you suggest that I am not quite as confident about my own philosophy as I might wish to be, you leave me cold. I doubt whether the system of statements which I regard as probably true deserves the name of a philosophy. And I am more, not less, confident about it than I wish to be. I have not adequately examined the grounds on which I hold some of my opinions. Even had I done so to the best of my ability I have no doubt that

I should be mistaken in many instances. However, in spite of this scepticism I think that I am probably nearer to the truth than you. Hence I accept your challenge.

Our first difficulty will be to find out what the other believes, or at least regards as probable. My task will be the easier. You are a Christian, and I shall assume that, with perhaps minor reservations, you stand by the Apostles' and Nicene Creeds. I will not add the Athanasian, which, in any case, has suffered seriously in translation. I also assume that you hold certain doctrines, such as the goodness of God and the wickedness of polygamy, which are not explicitly stated in the creeds (nor is the latter in the Bible), but which are generally held by Christians.

You will find it much harder, I fear, to pin me down. I certainly do not believe all that Darwin wrote, all that Wells, Russell, or Hogben write. Worse still, I do not now believe all that I have myself written. And, on the whole, my beliefs are a good deal more provisional than I imagine yours to be. Before you have done with me you will regard me as a slippery customer, an unfair controversialist, and a nebulous thinker. This last I am, because (as I am well aware) the verbal and other symbols which I employ in thinking are inadequate to describe the universe. You will look back with regret on the happy days when you engaged with Father Knox, who is bound to defend any statement found in the Penny Catechism, and who, I suppose, has spent as much time in controversy with his fellows as I have done in trying to discover new facts about the world. This demands a very different technique, because, when I frame a scientific hypothesis, my first task, if I am true to my own principles, is to try my hardest to disprove it. His task, which is both more congenial to most minds and a better preparation for controversy, has been to find further support for opinions of which he is already convinced.

I shall therefore be fighting with one hand behind my back. But I shall have two advantages over you. In your correspondence with Knox you and he will have had a good deal of common ground. You both agree to many statements which I regard as probably false, and which, during the course of your argument, you have not examined closely.

You will now have to turn round and fight in the opposite direction. In addition, I shall try my arguments on my wife before submitting them to your criticism.

I suggest that in your reply you should both attack and defend. On the one hand I ask you to controvert some statement of mine; on the other to defend some theory which you regard as highly probable or certain, while I do not; for example, that the world was made by an almighty and perfectly good person. I should like, I must confess, to deal with the argument used, I think, by St. Thomas and Maimonides before him, which both you and Knox have adopted. This argument purports to prove the existence of a creator from the impossibility of an infinite regress. However, I must not dictate the course of the controversy. Your move, sir.

Yours sincerely,
J. B. S. HALDANE.

III.

THE FIRST ROUND

October 30, 1931.

DEAR HALDANE,

I shall not quarrel with you over your enthusiasm for scientific thought, for I agree with you that most of our secular troubles are due to lack of scientific thinking.

The scientific method might, I suppose, be defined as the method which enables us to infer general laws from facts accurately observed and accurately recorded, and I imagine that you would be prepared to accept as a fair statement of the scientific ideal the following words of Thomas Huxley: "Sit down before fact as a little child, be prepared to give up every preconceived notion, follow humbly wherever and to whatever abysses nature leads, or you shall learn nothing."

There is nothing wrong with the scientific method; indeed, I should like to see it in more general use in the scientific world. My real quarrel with the majority of scientists is that they refuse to apply the scientific method to religion.

You suggest that your beliefs are "a good deal more provisional" than mine. I am not so sure.

In the first place, I think that both of us could describe ourselves as agnostics, had not that word acquired a purely sectarian meaning. The word "agnostic" should have been reserved not for those who reject the supernatural, but for any thinker, Christian or sceptic, who regards his solution to the great enigma as tentative and provisional rather than as final. Similarly, that useful word "gnostic," had it not been cornered by an early heresy, should have been used to describe those who believe that they have hit on a "gnosis," and who are confident that they have discovered the solution to the riddle of the universe. My brother, for instance, who writes under the name of Hugh Kingsmill, is a gnostic, but not a Christian, and I am inclined to think that your father is also gnostic rather than agnostic by temperament. Here is a sentence from his last book: " It is

not to the conception of a perfect God existing apart from what is clearly a very imperfect universe that philosophy leads us." An agnostic, in my sense of the word, would have concluded that sentence, " that my philosophy leads me." Moreover, an agnostic would probably have preferred as the title for these lectures, "The Philosophy of a Biologist," rather than "The Philosophical Basis of Biology."

Please do not misunderstand me. I am not suggesting that we should use established words, such as "agnostic," in any but their established sense. An accurate and unambiguous terminology is, as Aquinas has realized and many of our modern thinkers do not realize, as valuable in religion as in science. The adoption of Julian Huxley's proposal, for instance, to use the word "God" to signify "No-God," would scarcely make for clear thinking. I am only concerned to emphasize the distinction between those who do, and those who do not, regard their own philosophy as tentative and provisional, and to draw attention to the fact that our present terminology does not provide appropriate terms for this dichotomy.

You ask me to state my beliefs. I became an agnostic in the more usual sense of that word at the age of seventeen, as the result of reading Leslie Stephen's *Agnostic's Apology*. I waded conscientiously through the publications of the R.P.A., with the melancholy result that my faith in the rationalism of the Rationalists was gravely unsettled. I am sceptical by nature. I am convinced by evidence, not by assertion, and I could find no evidence for the great dogma of the Rationalists: "Miracles do not occur." Moreover, I soon discovered that whereas the code of the Christian is a logical deduction from the Christian's creed, there is no rational relationship between the faith and the code of a high-minded materialist. I was disappointed in my hope of building up a reasoned creed from Rationalism, so I re-examined the case for orthodoxy, with the result that I should be prepared to defend the first article in the Creed, "I believe in God, the Father Almighty." Again, I have devoted a good deal of time to the search for some natural explanation of the events of the first Easter Sunday, but have been driven back on the orthodox view as the only

satisfactory solution of the greatest of all historical problems. I am therefore prepared to defend against your criticism the cardinal doctrines of Christianity.

I should like to make it clear that my convictions are not the product of religious experience, for my religious experience is nil. The contrast between a living faith in Christ and an intellectual acceptance of the Resurrection is the contrast between a tropical forest and the stuffed exhibits in a natural history museum; but though I have no religious experience of my own, it would be as unscientific of me to deny the validity of religious experience as it would be for a man who was born blind to deny the reality of colour.

Our first task is, as you say, "to find out what the other believes." It is, however, equally important to analyse the process whereby we have arrived at our belief. I must therefore challenge your assumption that my approach to religious truth differs radically from your approach to scientific truth. You refer to Father Knox, and you state that his main interest is "to find further support for opinions of which he is already convinced." If this were really the case, he would clearly never have changed from a low churchman to an Anglo-Catholic, or from an Anglo-Catholic to a Roman Catholic.

"When I frame a scientific hypothesis," you write, "my first task, if I am true to my own principles, is to try my hardest to disprove it." But why should this admirable method be confined to scientific hypotheses? Why not apply it to the religious hypothesis, which I imagine you have always held, that the Resurrection is a myth?

Whether you have, in point of fact, applied this method to religious no less than to scientific hypotheses, is for you to say. So far as I am concerned, I know that I do not hold a single religious belief that I have not at some time or another made every effort to disprove. And to convince you that I am not merely trying to steal your thunder, let me quote from the proofs of my book with Father Knox, which lie before me as I write. After pointing out that no dogma "is regarded as sacrosanct in the scientific world," I continue: "Indeed the laws of religious research may be

not dissimilar to the laws of scientific research. We have no more right to expect to be spoon-fed in religion than in science. Religious truth may be the reward of research as arduous as that which is the price paid for scientific discoveries. Truth in religion, like truth in science, may be separated from falsehood by a long process of trial and error. The experimental method may be the right method in religion no less than in science."

I claim, therefore, that we agree so far as method is concerned, but I realize the difficulty of convincing you of this fact. Scientists have been amazingly successful in persuading both themselves and the general public that a man's attitude to truth is determined by the position of his collar-stud; in other words, that bishops who button their collars behind are biased, and that scientists who button their collars in front are always impartial.

I should like, with your permission, to devote my next letter to this important question, and I shall submit for your examination several instances, some from your own works, which seem to me to show that scientists are as strongly prejudiced as theologians against new facts or new arguments which conflict with their own *a priori* conceptions of the universe.

Briefly, then, I am prepared not only to defend my creed and to criticize yours, but also to try to show that my method of arriving at my religious beliefs is more scientific than yours. I hope that the outline of your creed will appear in your next letter.

Meanwhile there is a problem of terminology which you may be able to solve. You will not, I suppose, object to being described as a representative of a school of thought which disbelieves in a supernatural revelation and which bases its chief hopes for this world on the development of the scientific spirit. These two beliefs, negative and positive, represent, as I think you will agree, the H.C.F. of yourself and men like H. G. Wells, Bertrand Russell, and Julian Huxley.

There is unfortunately no satisfactory label for this school. I won't call you a Rationalist, as this would in effect be tantamount to admitting that Christians are

anti-rational; nor will I accept a label which would give colour to the error that there is any conflict between religion and science. Some scientists share your views and others do not. At the moment I can think of nothing better than secularist, but perhaps you can suggest something better.

Yours sincerely,

ARNOLD LUNN.

IV.

SCIENTIFIC METHOD

July 23, 1932.

DEAR LUNN,

Your letter of October 30th suggests that we may, after all, arrive at some common ground. But before replying to it in general may I deal with some details.

You suggest that the scientific method is "the method which enables us to infer general laws from facts accurately observed and accurately recorded." This is not what I mean by scientific method. It is only a small part of that method, and not, I think, the most characteristically scientific part. In the first place, it is incredibly difficult to observe some facts accurately, or to record them. To observe them we need a special technique; to record them, special symbols. I expect that Galileo spent far longer in making his telescope than in discovering Jupiter's satellites. Again, as a plant-breeder I can only record my flower-colours with the aid of a most elaborate set of colours called the "*Code des Couleurs des Chrysanthémistes.*" Now, I do not think that on the whole religious literature abounds in accurate observations and records of fact. For example, assuming that the resurrection of Jesus was a fact, it was inaccurately, or at least very inadequately, recorded by at least three of the evangelists, since their accounts do not quite tally.

A still more important part of scientific method is the devising of experiments or observations to test a hypothesis. I would go further and say that, from the scientific point of view, a hypothesis which cannot be tested by the fact that it enables us to predict a previously unpredictable phenomenon is a mere set of words. Some very great scientists, such as Faraday and Pasteur, have been predominantly experimenters rather than inferrers of general laws. For example, no one now takes Faraday's "tubes of force" between electrically charged bodies very seriously, but they enabled him to predict a mass of verifiable facts. So with

Pasteur's views on alcoholic fermentation. They were right enough to guide him towards a host of facts, but I am quite prepared to believe that St. Thomas Aquinas would have drawn truer deductions than Pasteur from these facts.

Your quotation from T. H. Huxley is interesting just because he was essentially an observer rather than an experimenter. Your experimenter does not "sit down before fact as a little child," or "follow humbly to whatever abysses nature leads." He does his best to take charge of the situation. Like a skilful barrister, he places nature in the witness-box and asks her simple questions, one at a time, being guided by his preconceived notions, but ready to give them up if they do not tally with the evidence.

So much for scientific method. I agree with you that my father is willing to carry his argument rather further from observable facts than I am, and I note that, like Lepidus in *Julius Caesar*, you are willing to sacrifice your brother as a make-weight to him. I also agree that there is (at least in many cases) "no rational relationship between the faith and the code of a high-minded materialist." But I disagree with you as to the great dogma of the rationalists, "Miracles do not occur." My own intellectual attitude to miracles is much the same as Hume's.

I will try to make it clear by considering an event which, so far from being miraculous, is quite possible. After the cards have been well shuffled a dealer at bridge may deal out one complete suit to each player. The odds against this event are, however (unless I have made a mistake, which is quite likely), about 4,470,400,000,000,000,000,000,000,000 to one. Let us divide this figure by a billion to allow for inadequate shuffling. Now if in your next letter you tell me that you have twice observed this phenomenon I shall say, "I have a high regard for Lunn both as a truthful man and an accurate observer; but I think it much more likely that he is lying or mad, or that he was deliberately deceived, than that the events he described really occurred."

So with most miracles. They are events which I judge to be highly improbable, though I cannot give a numerical estimate of the improbability. I shall only believe them if I judge that the improbability that their narrators were

deceiving or deceived is still greater. Now with regard to two types of "miracle," I think that the probabilities are fairly even. One is the type in which a medium or other person becomes possessed of knowledge by abnormal channels. The other is the type of healing performed at Lourdes. Most of the Lourdes miracles could, I think, be paralleled in ordinary medical practice. Skin diseases suddenly clear up, often, I suspect, through the patient's faith in electrical apparatus. Cancers are alleged to do so, but post-mortem examination shows that about ten per cent of diagnoses of cancer are false. Still, one or two of the more surprising Lourdes miracles, such as the immediate healing of a suppurating fracture of eight years' standing, seem to me to be possibly true, and, if so, very remarkable and worth investigating, although if they were shown to be true they would not prove the particular theory of their origin current at Lourdes.

But when we come to a really good miracle, involving not an unusual biological process, but a violation of those physical laws which hold both in living and non-living systems, I need much more convincing evidence. I agree that some mediums (or other beings acting through them) have done things which their audiences could not explain. But I have seen conjurers doing as much. And as I know that a great many mediums producing "physical phenomena" have been detected in fraud, I consider it more probable that the remainder are deceiving, deceived, or both, than that they are responsible for sudden breaks in the continuity of nature. I am quite willing to discuss any particular case that you like. But please do not ask me to investigate one. The average conjurer baffles me completely, and if I cannot detect a conjurer in bright light, I certainly should not detect a fraudulent medium in partial darkness.

With regard to the miracles in the Bible, I should find them so much easier to believe were it not for Mark xvi. verses 17 and 18: "And these signs shall follow them that believe; in my name shall they cast out devils; they shall speak with new tongues; they shall take up serpents; and if they drink any deadly thing it shall not hurt them; they

shall lay hands on the sick, and they shall recover." The preceding verse stated "He that believeth not shall be damned." Now here I have a statement on the same authority as that for Jesus' miracles. It is a statement that I can test. Do you honestly think that no believing Christian has ever been poisoned, and that every victim of poisoning in Europe to-day is damned? Of course not. But I shall be interested to hear just how you do get round that particular text. If it were not for a few statements of that character which one can test by the evidence of one's senses to-day, the Bible would be vastly more credible than it actually is.

So much for miracles for the moment. You will doubtless be able to ask me why I consider a violation of certain physical laws improbable, and why I regard certain very surprising events, such as the descent of man from fish, as having probably happened.

Now with regard to the Christian attitude. I am quite prepared to stick to my remark about Father Knox, unless he has changed his mind since writing the last of his theological books that I have read. He believes that reason will convince any right-thinking man of the existence of God; and a study of the Bible and perhaps other documents has further persuaded Father Knox that God was incarnate in Jesus, and founded an institution called the Catholic Church. This, he holds, is quite a sufficient reason for believing in its dogmas. But, like any other Catholic philosopher, he is quite willing to so his best to persuade himself and the world that these dogmas form a coherent system. He further holds, I take it, that faith is a virtue, and that the more firmly he believes in these dogmas the better a man he is.

I take it that your attitude to faith is somewhat different, or you would not have tried your best to disprove your religious beliefs. It is, you see, very largely the Christian theory of faith which has made scientists and others believe that bishops are biased. After all, if you recite the Athanasian creed, which contains the statement that unless a person holds the Catholic faith as there defined "without doubt he shall perish everlastingly," it creates a certain

presumption that you will try to avoid that fate, even at the expense of your intellectual integrity. If it were known that I thought that I should lose my job (a small matter compared with losing my soul) if I felt doubts on the efficacy of vaccination, natural selection, or Dumas' method of nitrogen determination, my statements on those topics would be received with less respect than they are now. The bishops cannot have it both ways. They use the theory that faith is a virtue as a method of propaganda, and expect us to believe that this theory does not affect their judgment.

But in your next letter you are going to condemn me out of my own fountain-pen, and prove that my proper place is on the bishops' bench rather than in the professor's chair. So perhaps the less I say against bishops the better.

However, in answering your letter, I have stated a part of my case against religions, and more particularly Christianity and Islam, which make faith a virtue. In the past millions of people have stifled their own reason, and hundreds of thousands have been killed and tortured because doubt was regarded as a sin. To-day this attitude does not greatly affect your or my intellectual freedom. But it emphatically affects that of the average citizen. The ordinary child in England is taught a diluted Christianity and a vastly more diluted science. He or she never hears the scientific anti-religious view of people like myself, nor, I should suppose, the intellectual case for Christianity. He is not given the case for or against evolution, and I should like to see him given both (say a little book by me, with caustic foot-notes by you). It is the same when he grows up. Look at the B.B.C. talks on Science and Religion this spring. The case against religion was entrusted to Huxley, who thinks he is religious, and Malinowski, who would like to be, rather than to an outright opponent of religion, like Keith or Chalmers Mitchell. Hence when the average person drifts away from religion he finds no substitute for it, and makes himself and others miserable.

I do not think the scientific attitude to those who attack what you might call the dogmas of science is quite so bigoted. For example, I admit to a certain exasperation when Mr. Joad attacks Darwinism with a sublime indifference

to a mass of known facts, but I am delighted to read a really well-informed anti-Darwinian book like Berg's *Nomogenesis*, because the true theory of evolution, whatever it is, will have to explain a lot of Berg's facts. I doubt if a similar attitude is very common among professional religionists, simply because, as I think, they are biased by the theory that faith is a virtue, whereas I hold that clear thinking is a virtue, even if at first it leads to false conclusions. I hasten to add that I do not suppose that I always live up to my principles, and have no doubt that you will be able to catch me out in violating them. I shall not be too ashamed of a moderate number of such lapses. I am, after all, human.

Similarly, I will forgive you for begging the question when you speak of having searched for a natural explanation of the events of the first Easter Sunday. The facts to be then explained are the existence of several accounts of these events, and of organizations inculcating a belief in them.

You want to know what I believe, and how I came to believe it. I probably do not believe anything as firmly as you do. For example, I am prepared to admit the possibility that I am nothing but a biologically and socially convenient fiction, that some hundreds of millions of Buddhists, in fact, are correct in referring to "the illusion of personal identity." In any case, our words and other symbols are so inadequate to reality that it seems likely that any statement which can be made on any subject contains at least an element of falsehood, unless, perhaps, it is a purely logical statement. Certainly our ordinary ideas about space, time, matter, and so on prove misleading when pressed too far. But, for all that, there are statements which are true enough for practical purposes. "My wife is in the next room," "I own a motor-car," and so on, the sort of statements on which an intelligent jury forms its opinion. I believe very strongly in the truth of a vast number of statements of this kind. Others, such as "Cerdic was a leader of a Saxon invasion of southern England," seem to me highly probable, but not certain. Others, again—for example, "Jesus changed water into wine"—seem to me definitely improbable. Some propositions

about the remote past—for example, the evolution of man from animal ancestors—seem to me rather more probable than the existence of Cerdic, but less so than that of Queen Anne.

There are also some general truths of a timeless character —for example, "Twice two are four"—in which I believe pretty thoroughly. On the other hand, any general statements that I may make about the universe are likely to contain a large element of falsehood, because my words are not suited to such statements. I have certainly no clear beliefs about it to pit against your "In the beginning God created the heavens and the earth."

I could, I think, give you fairly good reasons for my "belief" in all the statements which I regard as highly probable. You are interested in my reasons for regarding some statements, such as the truth of various miracles, as improbable. I think it is up to you to tell me why you believe in them, but if you ask me to I will take the contrary course. I acquired my more disputable beliefs in much the same way as you acquired your belief in Queen Anne or Kerguelen Island. I tested some of the relevant facts and took the rest on trust, believing that I could test most of the others if I took the trouble.

I never believed in the major miracles, any more than (I suppose) you ever believed that Mars begat Romulus and Remus. I had plenty of Christian propaganda, and some for other beliefs, such as Judaism, materialism, and theosophy, pumped into me. None of it has convinced me.

Now let me give you some points. I agree that there is often no rational relationship between the faith and (moral) code of a high-minded Rationalist. I, at any rate, do not claim to know enough about the universe to say what connexion there is between, say, the starry heavens and the moral law. You believe, I take it, that God made both. I am also willing to be called a secularist, though I don't much like the word. But provided you do not call me to account for all the remarks of other secularists, I accept the label, as conveying something more positive than the word "infidel."

I feel, by the way, that I owe you a written apology for

my delay of some eight months in answering your letter. I had to grapple with the proofs of two of my books, one in German, and some purely personal events threw a good deal of other extra work on me. I did not feel able to answer you until I had taken a holiday. But my conduct might legitimately serve to confirm your belief (if you hold it) that infidels are not to be trusted. I hope that in your reply you will not only expose my inconsistencies, but your own grounds for belief in statements which I find improbable.

Yours sincerely,
J. B. S. HALDANE.

V.

IN DEFENCE OF RATIONALISM

SUTTONCROFT,
BICKLEY.
August 14, 1932.

DEAR HALDANE,

Your controversial style is disarming after the invective of my friend Joad. Where he shouts *Écrasez l'infame* you are content to insinuate doubt not only of God's existence but also of your own. A quarter of a century has passed since Mr. Chesterton foretold that suicide of thought which is the ultimate end of scepticism. The old sceptics began by doubting the existence of God. The modern sceptic ends by doubting his own existence. "We are on the road," wrote Mr. Chesterton, "to produce a race of men too mentally modest to believe in the multiplication table. . . . The creeds and the crusades, the hierarchies and the horrible persecutions were not organized, as is ignorantly said, for the suppression of reason. They were organized for the difficult defence of reason. Man, by a blind instinct, knew that if once things were blindly questioned, reason would be questioned first."

I shall be interested to learn how you propose on the foundation of these delicate negations to erect an ethical system which shall remedy "the present alarming condition of the human race" which you deplore. But I have my doubts of the vitality of a crusade whose leader is prepared to admit that he is "nothing but a biologically and socially convenient fiction." It is certainly difficult to convince a man who is not sure that he exists that his Creator exists.

Your amplification of my attempt to define the "scientific method" is very welcome, for the experimental method is not peculiar to science and should be applied to religion.

I must defer for the moment any discussion of the reasons why Catholics consider that Faith is a virtue. I will content myself with stating that Catholics would not accept the distinction which you try to draw between faith and clear thinking. They hold that clear thinking leads to the Faith,

and that thinking confused by defective education, sin, or conceit leads to heresy.

You have defined in a clear and interesting fashion your attitude to the supernatural. I can sympathize with you because my own attitude was once very similar. It is very difficult for men of our generation to escape from the prison of our time. The mental fashion of the age is anti-supernatural. We start with the assumption that God, if he exists, would never dream of interfering with the routine of nature. The assumption, indeed, is so embedded in our thought that we do not even realize that we are guilty of assuming as true a theory which is against all the weight of historic evidence.

It was some little time before I realized that this attitude was parochial in the extreme, for it is parochial to assume that we are in touch with no forms of consciousness higher than man. I say "in touch," for I am not concerned with the possibility that the planets may be inhabited by beings more intelligent than man.

I cannot understand why it should be considered scientific to assume that only the uneducated or old-fashioned could possibly believe in angels or evil spirits.

As that distinguished French scientist Professor Richet remarks: "Why should there not be intelligent and puissant beings distinct from those perceptible to senses? By what right should we dare to affirm on the basis of our limited senses, our defective intellect, and our scientific past, as yet hardly three centuries old, that in the vast cosmos man is the sole intelligent being, and that all mental reality always depends upon new cells irrigated by oxygenated blood?"

You scientists are always urging us to cultivate a sense of proportion and to realize that man is a native of a small planet attached to an insignificant star. You yourself have preached many sermons on this cheerful text. But surely it is no more conceited to believe that the earth is the centre of the universe than to assume that man represents the climax of the evolutionary process, and that in all the vast universe there are no beings of higher spiritual worth. (Incidentally, scientists are now inclined to think that this

planet may, after all, be the sole abode of consciousness in the universe, so perhaps the mediaeval cosmogony was not quite so absurd after all.)

For the life of me I cannot see any reason to suppose that we are not surrounded by a great company of invisible witnesses, and I shall continue to believe that we are until science provides me with something more than mere noisy assertions to set against the vast array of evidence for the supernatural which has been accumulated in every age and by every race from the dawn of recorded history.

> The angels keep their ancient places;
> Turn but a stone and start a wing!
> 'Tis ye, 'tis your estranged faces
> That miss the many-splendoured thing.

There is more sober scientific fact in those four lines than in half the papers read before the British Association.

The "rationalist" who rejects the supernatural is always in danger of assuming the conclusion which he is required to prove. It is, for instance, a *petitio principii* to assume, as you have done, that because miracles are admittedly unusual therefore miracles are improbable. I maintain that we have every reason to expect that God should manifest himself by miracles, and further that we have no right to expect that these miracles should be matters of common occurrence. In other words, I shall try to show that miracles are probable and that it is probable that miracles should be unusual.

The degree of evidence which we require in the case of a miracle is necessarily far stronger than the evidence which justifies a jury in bringing in a verdict of guilty in a capital charge, and I hope to satisfy you in later letters that the evidence for miracles satisfies this exacting test. Most rationalists, however, are not prepared to consider for a moment any evidence, however strong, for the miraculous. Zola, unable to explain a cure at Lourdes which he had investigated, added, "I don't believe in miracles: even if all the sick in Lourdes were cured in one moment I would not believe in them!" Clearly this attitude is founded not on reason but on faith—faith in the dogma that miracles do not occur.

And indeed the inspiration of nineteenth-century rationalism was not reason but the determination to uphold a particular philosophy against the weight of historical and scientific evidence. Strauss, for instance, laid down as a canon of New Testament criticism the dogma, "In the person and acts of Jesus no supernaturalism shall be allowed to remain," and he accordingly dates the gospels on the assumption that miracles must be a later interpolation. If Strauss' principles were applied in our courts of law we should doubtless be favoured with some such exchange of remarks between judge and counsel as the following:

Judge: "You propose to call this witness for the defence?"

Counsel: "Yes, my Lord."

Judge (with a slightly puzzled air): "But the witness for the defence believes in the prisoner's innocence."

Counsel: "Yes, my Lord."

Judge: "Then I rule that his evidence is inadmissible. In the person and acts of the prisoner no innocent motives shall be allowed to remain."

Again, I have never been able to discover by what canon of criticism the rationalist selects his texts. Like the modernist, he assumes the accuracy of those texts which suit his particular theory, and denies the reliability of texts which support the views which he combats.

Nothing is more difficult than to report conversation accurately. Indeed, Boswell is one of the few people in history who have reported with accuracy the *ipsissima verba* of their heroes. In a police court a witness who was accepted as a reliable witness of a conversation would certainly be believed if he reported some striking incident. It is therefore difficult to understand why the hostile critic of the gospels assumes that the evangelists were more accurate than Boswell when they report words which the Christian may find some slight difficulty in explaining, and less accurate than a hysterical girl frightened by a ghost when they report incidents which the rationalist is anxious to explain away.

And now for miracles. To clear the ground, let me state at the outset that I do not include under the term "miracle" any form of faith healing which might conceivably be explained by scientific laws not as yet fully understood. I

mean events such as the feeding of the five thousand or the Resurrection, which suggest the *modification* of the laws of Nature by the intrusion of supernatural will.

Please note that a miracle is neither the *violation* nor the *suspension* of a law of Nature. "When the human will," writes Dr. Harris, "acts upon the external world, and produces a sensible effect, it does not thereby violate any law of Nature. When, for instance, a man raises a stone weighing a hundredweight, and holds it in his hands he does not in so doing violate or suspend the law of gravitation. That law continues in full force, as is proved by the continuance of the sensation of weight; but the effect of the law is counteracted by the operation of the greater force of the human muscles, directed by the human will. Similarly, when God works a miracle, it is not supposed that any of the laws of Nature are suspended, but that God counteracts or modifies some of the effects which those laws would ordinarily produce, by a process analogous to that by which the human will acts upon and influences physical Nature. This is admitted by John Mill, who says: 'The interference of human will with the course of Nature is not an exception to law; and by the same rule interference by the divine will would not be an exception either.'"[1]

If God exists, and if he is in the least interested in the human beings that he has created, it is not unreasonable to suppose that he should give men some evidence of His existence.

On the other hand, we need not be surprised that God is sparing of miracles. He does not coerce faith, for it would be inconsistent with his gift of free will to render it, humanly speaking, impossible for a man to reject God.

Very well then. I have tried to show first that the complete absence of miracles would be far more surprising than the occurrence of miracles, and secondly that we should expect miracles to be unusual occurrences, and we should expect, since God does not coerce faith, that the evidence for miracles, though strong enough to satisfy anybody who approached the subject with an open mind, would not be completely coercive for the world at large.

[1] *Pro Fide*, p. 269 (John Murray).

I am surprised that you should describe your attitude to miracles as similar to that of Hume, for I thought Hume's fallacies had been pretty thoroughly exposed. Mill, a sceptic, but a logical sceptic, rejected his "argument" as unsound. "A miracle," says Hume, "is a violation of the laws of Nature; and as a firm and unalterable experience has established those laws, the proof against a miracle, from the very nature of the fact, is as entire as any argument from experience can be."

First, miracles are not "violations of the laws of Nature" (see above).

Secondly, it is poor reasoning to assume what it is your business to prove. We maintain that so far from the case against miracles resting on "firm and unalterable experience," there is a vast amount of unimpeachable evidence in favour of miracles. The question, as Mill rightly said, "can only be stated fairly as depending on a balance of evidence: a certain amount of positive evidence in favour of miracles, and a negative presumption from the general course of human experience against them."

And now for your bridge illustration. You tell me that if I stated that I had *twice* seen the distribution you name you would be inclined to doubt my veracity or my sanity, or both. I am grateful for the delicate compliment of the "twice." Will you think me very rude if I reply that I should not accept your statement if you had said that you had witnessed this distribution *once*?

The odds against this distribution are even greater than you suppose. Inadequate shuffling does not, as you suggest, *reduce*, but increases, the odds against this distribution. The cards are stacked in tricks, and the majority of tricks are composed of cards of the same suit. Therefore if we re-dealt without shuffling, your distribution would be impossible, and is perhaps impossible without shuffling far more prolonged than is ever possible under the normal conditions in which bridge is played.

In any case the odds against this distribution are so astronomically immense that if every member of the human race had been playing bridge for six hours a day from the dawn of the Stone Age down to modern times, the odds

against this distribution having occurred *once* would still be many billions to one. Do you know of any well-authenticated case? I know of none, and I am inclined to suspect the reported cases of one suit being monopolized by one player are the result of a practical joke.

If, then, you were to tell me that you had seen the four suits distributed, one suit to each player, I should believe that you had been deceived; whereas if, on returning from Lourdes, you told me that you had seen a completely fractured leg united in a second of time I should believe you. And I should believe you for the good reason that whereas I know of no evidence that this particular Bridge distribution has yet occurred, there is a constant stream of first-class evidence throughout the ages as to the occurrence of miracles such as those which are reported from Lourdes. I propose in later letters to summarize this evidence, and also to discuss your reasons for refusing to be impressed by "physical phenomena" as produced in séances, and I will confine myself for the moment to an attempt to show that your arguments against New Testament miracles can be refuted.

The example you give (Mark xvi, verses 17 and 18) is an interesting illustration of the ease with which even a clear thinker can miss the point of a passage if he reads that passage with a prejudiced mind.

In the first place you have divorced the texts you quote from the context which explains them. Let me quote the passage in full. The passage contains Christ's final exhortation to the apostles, an exhortation delivered after the Resurrection :

"And he said unto them, Go ye into all the world, and preach the gospel to every creature. He that believeth and is baptized shall be saved; but he that believeth not shall be damned. And these signs shall follow them that believe; In my name shall they cast out devils; they shall speak with new tongues; They shall take up serpents; and if they drink any deadly thing, it shall not hurt them; they shall lay hands on the sick, and they shall recover. So then after the Lord had spoken unto them, he was received up into heaven, and sat on the right hand of God. And they went

forth, and preached every where, the Lord working with them, and confirming the word with signs following. Amen."

You ask me, "Do you honestly believe that no believing Christian has been poisoned?" and I reply, "Do you honestly believe that the passage you have quoted suggests that believing Christians are immune from snake-bite?" Surely the passage is not a general statement applying to Christians as a whole, but a particular prophecy as to the miracles which would be associated with the missionary activities of the little group of apostles to whom Christ addressed these words: "Go ye into all the world, and preach the gospel. . . . And these signs shall follow them that believe. . . . And they went forth . . . the Lord working with them, and confirming the word with the signs following."

What could be plainer?

It is, moreover, a matter of history that these signs *did* follow them that believed. The apostles "spoke with new tongues," and healed the sick; and at Melita a viper came out of the fire and fastened on St. Paul's hand, and St. Paul, to the amazement of the barbarians, received no hurt.

The particular prophecy was fulfilled; but even had the prophecy been tolerant of your interpretation I should have had no difficulty in defending it. I do not believe that every "believing Christian" is immune from snake-bite, but I do believe that it is impossible to set bounds to the powers of faith. Believing Christians vary enormously in the vigour of their faith. I am quite sure that I am not immune from snake-bite. I am equally convinced that many of the saints could have handled poisonous snakes with the same casual confidence that St. Paul displayed on the "island called Melita."

You mention the discrepancies in the accounts of the Resurrection. No four witnesses reporting the same event will give exactly the same account. Had the four evangelists told the same story in identical words the hostile critic would have asserted that they had all copied the same account, and that the witnesses to the Resurrection were therefore reduced from four to one. Minor discrepancies do not invalidate the credibility of the main story in its main

outlines, and may only legitimately be used, if at all, to impugn the theory that the Bible contains no error. But even this line of attack, as I found in my correspondence with Father Knox, is not particularly helpful.

"The facts to be explained," you write, "are the existence of several accounts of these events, and of organizations inculcating a belief in them." I have explained the first point, and it is for you to explain the account of the Christian Church on the assumption that the Resurrection did *not* take place. The Church is no puzzle to those who believe in the Resurrection.

I am impressed by the tone of your letters, reasonable and tentative, both in what you affirm and in what you are inclined to deny, and I am puzzled to account for the contrast between your letters to me and the curt dogmatism of your published references to Christianity.

I should have been surprised had you made in this correspondence the remark which you broadcast over the wireless: "The creeds are full of obsolete science"; but it does not seem to me quite fair that you should reserve these remarks for occasions when they cannot be challenged, and for a public which accepts them at their face value, and which does not realize the very tentative nature of your views. There is, of course, no science, new or obsolete, in the creeds. The only thing that is full of obsolete science is—science. I should be interested to learn how you would begin to justify your prophecy that the Christian Churches, "if they maintain their influence, will sterilize scientific thought," and I should be glad if you would name a single scientific fact which is at variance with a defined doctrine of the Catholic Church. There is an unending conflict between science and scientists, for I need not remind you of all that scientific pioneers have had to suffer from the jealousy and obscurantism of organized science; but all this talk of the conflict between science and religion is very much beside the mark.

There is, I think, one point on which we shall be in agreement. You will unite with me in regretting the widespread ignorance of that which should be regarded as an integral part of culture, a knowledge of the history and

philosophy of a religion which for sixteen centuries influenced every aspect of European life. In your first letter you said that you would have been mildly amused or annoyed had I accused you of writing ignorantly or in bad faith. True, like Mr. Wells and others, you have confused the Immaculate Conception with the Virgin Birth; even so I make no general accusation of ignorance or bad faith, for passages such as the following are rare in your works:

"The old religions are full of obsolete science, including the astronomical theory of a solid heaven, the chemical theory that water, bread, books, and other objects can be rendered holy by special processes, and the physiological theory that a substance called a soul leaves the body at death."

I will pay you the compliment of not asking you to defend this travesty of Catholic doctrine.

There is not much in your work at which a Christian could legitimately take offence. Christians, by a process of natural selection, long ago developed very thick skins, and your satisfied statement that you do not "worship a biscuit" would be met by the mild rejoinder that it is unscientific to equate the small with the trivial, as Bethmann-Hollweg discovered when he referred to a "scrap of paper."

A Christian would, I think, ignore your occasional contemptuous references to the Faith, and would be most disposed to quarrel with you for your tacit assumption that your reader has no right to demand definitions of your terms or a reasoned argument in defence of your particular brand of supernaturalism. St. Thomas Aquinas would have criticized severely your tendency to rely not on reason but on faith. And he would condemn your habit of using nebulous phrases the meaning of which you have made no attempt to define. But he would make allowances for the age in which you live, an age which takes refuge from the discipline of exact thought in the mists of metaphor.

"I believe," you write, "that the scientist is trying to express absolute truth and the artist absolute beauty."

St. Thomas would never have used a phrase like "absolute truth" without defining what he meant by "absolute." All this modern talk about "values" is merely an attempt to

admit the supernatural at the back door. Our generation suffers from what might be called logophobia, the fear of words. Certain words like "God" and "supernatural" are unfashionable, and so our moderns are reduced to talking about "absolute beauty" and the "realm of values." But all this is mere metaphor-mongering. How is it conceivable that eternal values can exist without an eternal God to conserve those values? You have recently affirmed your belief that "the meaning of the visible world is to be found in the invisible," and elsewhere you tell us that you have "not much use for people who are not in touch with the invisible world." What precise meaning do you attach to this phrase "invisible world"?

Now, a thinker trained in the austere school of Christian rationalism will find this vague talk about the "invisible world" unsatisfying. The Christian, like St. Thomas, insists on proof before accepting the supernatural, even though it be disguised as "absolute beauty."

Again, the Christian rationalist is perplexed by the modern attitude to immortality; for the modern sceptic does not begin by asking, as Socrates would have asked, whether life is good and therefore whether more life is better than less life. He assumes that man is mortal and proceeds to lecture those who disagree on their selfish interest in their own petty personalities.

There is nothing selfish in desiring that the whole human race should possess immortal souls, for selfishness is the search for personal happiness at the expense of other people. It would be so much easier to understand modern theology if our modern theologians would consult a good dictionary.

"I shall last out my time," you write, "and then finish. This prospect does not worry me, because some of my works will not die when I do." But your works will perish with the solar system, and if the individual is mortal his works are certainly not immortal.

In the same paper you tell us that you are proud to be a citizen of the British Empire, because the expectation of life is greatest in New Zealand, and next greatest in Australia. "I am proud to belong to a Commonwealth which

has won the first and second places in the great race against death."

The Christian, then, may surely feel proud to belong to a Church which has left death standing at the post.

You are thrilled to discover that the expectation of life in New Zealand is sixty years. Why is it important for Mr. Jones to die at sixty rather than fifty-five and unimportant for Mr. Jones to continue living indefinitely beyond sixty? It would seem that it is important for us to increase our expectation of life by 10 per cent, but selfish of us to desire to increase it by infinity per cent. I cannot quite follow the argument. Please enlighten me.

In your *Conway Memorial Lecture* you write as follows: "Just as, according to the teachings of physiology, the unity of the body is not due to the soul superadded to the life of the cells. . . ."

Would it not have been more accurate to write: "Just as, according to some physiologists"? I do not think it is legitimate to substitute phrases such as "Science teaches" or "Physiology teaches" when you are merely voicing your own personal opinion. The quotation continues: "So the superhuman, if it existed, would be nothing external to man, or even existing apart from human co-operation. But to my mind the teaching of science is very emphatic that such a Great Being may be a fact as real as the individual human consciousness, although, of course, there is no positive scientific evidence for the existence of such a Being. And it seems to me that everywhere ethical experience testifies to a super-individual reality of some kind. The good life, if not necessarily self-denial, is always self-transcendence."

Your confession of faith is characteristic of our age. First, because you obliterate the frontiers between religion and science. It is theology, not science, which teaches us that a Great Being exists. We can prove that God exists by pure reason without entering a laboratory or consulting modern astronomers.

Secondly, your confession is symptomatic of the growing realization that Naturalism is not enough. You have done your best to eliminate God, but—*usque recurret*. Will you

forgive me if I seem to detect in this passage the evidence of an *anima naturaliter Christiania*, a soul unnaturally divorced by the infection of theophobia from that great religion which provides the only reasoned basis for that life of self-transcendence which you rightly admire?

Thirdly, your confession of faith is interesting, because it is modern in the sense that the moderns are abandoning all effort to ground their beliefs on reason and on evidence. To conceive of God as related to man much as man is related to his cells is an ingenious fancy, a fancy which would have delighted Fechner; but it is nothing more than a fancy. It is neither probable nor plausible. By faith, and faith alone, can we even begin to believe in your synthetic God. I lack the requisite faith, for I am only a poor rationalist, a revenant from the greatest of all rationalistic centuries, the thirteenth, a century in which St. Thomas began, not with an ingenious fancy divorced from experience, but with the most obvious fact of experience, the fact that some things are in motion. And upon this irrefutable premise he proceeds to build the magnificent edifice of scholastic theology.

Certum est enim, et sensu constat, aliqua moveri in hoc mundo. And upon this rock will I build my faith.

Yours ever,

ARNOLD LUNN.

VI

WORDS AND REALITY

University of California,
Berkeley, Cal.
November 10, 1932.

Dear Lunn,

Your letter of August 14th has now been sent on to me here. Before I answer your criticisms, let me correct what I think is an error on your part. To the best of my knowledge I have never confused the dogma of the immaculate conception (of Mary) with that of the virgin birth (of Jesus). If I ever refer to the former, I invariably receive indignant letters accusing me of this confusion. It does not always pay to assume that those who disagree with you are ignorant. However, if you can substantiate your accusation I apologize in advance. I must also warn you that I am not proposing "to erect an ethical system." I do not doubt that you could demolish any system that I might erect. I am prepared to defend certain ethical propositions, but that is all.

Now for your other criticisms. You are inclined to suspect that there will be some difficulty in recruiting crusaders for a movement led by a prophet who is "prepared to admit that he is nothing but a biologically and socially convenient fiction." You may be right. History does not repeat itself exactly. But you will doubtless remember that such a movement, namely, Buddhism, met with some measure of success in the past. One of its prime dogmas (at least, in the Hinayana sect) is that personal identity is an illusion. Of course, however, Buddhism was not a crusade. The doctrine to which I refer was disseminated by argument rather than massacre.

I would not go all the way with Gautama. I would have been well advised to style myself an abstraction rather than a fiction. But I think that the limits of human personality are so ill-defined that one may readily fall into error if one draws them at any particular place. Thus, a well-behaved child may get lethargic encephalitis, and henceforth behave

very badly, stealing, quarrelling, lying, and so on. Are we to say that the child has become wicked? Or is the bad behaviour due to something external to the child, which is "really" as good as ever? In the first case we extend the idea of personality to include a microbe in the brain. In the second we admit that character and actions may be unrelated, a convenient doctrine for criminals. I try to escape from such dilemmas (they occur in connexion with matter as well as mind) by frankly admitting that our ideas about most, if not all, things are self-contradictory. We cannot as yet say where an individual ends or begins. And we may as well admit, as a preliminary to accuracy, that any boundaries which we may draw are fictitious.

To put the matter rather differently, I admit that in all probability my words and thoughts do not correspond exactly with reality. This is what you call intellectual suicide, or the flight from reason. I should call it a flight from words. It is, as you later remark, characteristic of the age in which I am fortunate enough to live. We (for you have kindly given me the right to speak for my contemporaries) have lost the illusion that when we carefully define a word by means of other words we have necessarily made an important step towards the truth. On the contrary, we try to find out whether our words really stand for something definite. Thus it turns out that copper (an element) stands for something much more definite than bronze (a variable mixture), and water (a definite compound) than air (another variable mixture). These facts were discovered by careful experiment. As the result of this we can define air or water more exactly than our ancestors. No amount of reasoning, so far as I can see, could have taken the place of these experiments. Nor, of course, could the experiments have led anywhere without subsequent reasoning.

But your mediaeval friends erected an elaborate structure of reasoning on a very inadequate foundation of facts, just as they built Winchester Cathedral on a foundation of beech logs, which our modern age has replaced with concrete. Moreover, as will appear when we examine their arguments, they reasoned pretty loosely at times.

I fear that Mr. Chesterton is unduly optimistic in predicting a race too modest to believe in the multiplication table. Such a disbelief would only be temporary, I think, but it would be a very salutary phase. You will remember that Descartes claimed to have achieved it for a while. On the rebound from such scepticism he invented co-ordinate geometry, a much finer mathematical tool than the multiplication table, which, by the way, was not part of the general knowledge of "educated" men during the Middle Ages. Intellectual modesty may be carried too far, but I do not think most people carry it far enough.

Now for your *a priori* arguments for miracles. I do not assume that we are in touch with minds higher than our own. I know of no adequate evidence for this theory, and wait for you to prove it. I also know that one can manage one's life fairly well without this belief. Also please note that "Why should there not . . ." is a poor beginning for an argument. Why should there not be a complete copy of the ten commandments, or a portrait of Lenin, on the back of the moon?

If you succeed in proving the existence of one or more such superior beings you will undoubtedly have a good *a priori* argument for miracles, and against the scientific point of view. May I quote John of Arras, as rendered by his mediaeval English translator? "David the prophete saith, that the Juggements and punysshinges of god ben as abysmes without bottom and without ryvage. And he is not wyse that such things supposeth to comprehende in his wit and weneth that the meruaylles that ben through the uniuersalle world, may nat be true, as it is said of the thinges that men call ffayrees, and as it is of many other thinges whereof we may not have the knowleche of all them." [1] Then follows the story of the fairy Melusine, who was liable to become "fro the nauel downward in lyknes of a grete serpent, the tayll as grete and thykk as a barell." That is where, in the opinion of many mediaeval writers, who were not censured by the Church, your argument leads.

If there are such superior beings (it remains for you to

[1] Early English Text Society, N.S., 68.

make this plausible) we might, as you say, expect them to intervene in the course of events as we do ourselves. Now when a man lifts a stone the energy employed comes from chemical processes going on in his body, which are not so very unlike those in a steam-engine. To be accurate, we can equate the man's output of energy with that available from the oxidation of his food with an accuracy of one part in two thousand. I do not suppose that you think that similar processes go on in God's body, or a spirit's body, when a miracle is performed. Unless this is so, there is no close analogy between a miracle and a voluntary act. I contend, therefore, that a miracle (unless it can be explained by an unusual natural occurrence, like some of the plagues of Egypt) is a violation or suspension of the laws of nature. If God made these laws, I can see nothing unlikely in His suspending them.

In spite of your quotation from Hume, I think my attitude is similar to his. Hume did not take the evidence of the firmness of the laws of nature for granted. He analysed the evidence for their existence. He also discussed some alleged exceptions to them. So his statement was not a mere assumption.

With regard to my bridge illustration, I do not agree with you about shuffling. One method of shuffling consists in allowing the two halves of a pack to interpenetrate. If, in a no-trump hand, the suits had been played out in turn, and all the players had followed suit in most of the tricks, two such shufflings in which a card from one half the pack was placed between every card of the other half, would tend to concentrate the cards of one suit in the first, fifth, ninth, etc., places in the pack, so that they would be dealt into one hand. Or so it seems to me. But perhaps I stated my case too modestly. Anyway, we agree on the fundamental point at issue. I certainly know of no well-authenticated case of that particular miracle.

As to Mark xvi. 17, 18, I fear that I stick to my former opinion. The second sentence: "He that believeth and is baptized shall be saved; but he that believeth not shall be damned," is usually taken as referring to people in general —myself, for example. The signs of belief (e.g. immunity

to poison) are given in the next sentence. I had always assumed both sentences to have a general application. If the promise and threat of the second sentence only apply to the apostles' hearers, like the immunity to poison, then the modern Church has less to offer than is generally thought. And I contend that if you regard the two sentences as referring to different sets of people, it is you, not I, who "reads that passage with a prejudiced mind."

As regards the resurrection, I do not agree with you that the discrepancies are "minor" ones. It is quite possible to give four accounts of the same event in very different words which do not contradict one another. Read the accounts of the same football match in four different papers if you doubt this. Clearly we shall have to discuss the whole problem in detail later.

Now for my "curt dogmatism." You quote some sentences from my broadcast address, but omit two which preceded them all. They read as follows: "But the intellectually honest man must realize the utterly provisional nature of his beliefs. So when I make an apparently definite statement, I must ask you to put before it some such words as 'It seems to me very probable that . . .'" If this is dogmatism you can lock me up in a padded room with the Pope, the Dalai Lama, and Mr. Joseph McCabe! In the next paragraph I assert that the creeds are full of obsolete science. You then say that the public "does not realize the very tentative nature of my views." It would do so if it read or listened consecutively. I am inclined to think that it quite often does both. And I am beginning to wonder whether Zola and Strauss may not perhaps have qualified their apparently dogmatic remarks by statements which you omit.

I still assert that the creeds are full of obsolete science. For example, the theory of a solid heaven, or firmament, is to be found in the book of Genesis, the book of Revelation, and here and there in the intermediate parts of Holy Writ. It was, of course, the usual scientific theory before the time of Copernicus. It was clearly in the minds of the framers of the creed who said, "He ascended into heaven, and sitteth on the right hand of God the Father Almighty. From thence he shall come to judge the quick and the dead." I

should like to know your attitude to this statement. You agree, I take it, that Jesus rose from the earth's surface. If so, His body either came down again, reached a place called Heaven, is still moving, or was annihilated. Which alternative do you prefer? You would presumably regard the phrase about Jesus sitting as a metaphor. But the phrase about His resurrection is to be taken literally. So is that about His virgin birth—until a knowledge of genetics is as widespread as that of astronomy.

I certainly regard the theory that bread can be altered by the action of a priest as chemical. If Jesus ascended into heaven that was an anomalous physical phenomenon. If bread is converted into His body and blood that is an anomalous chemical phenomenon. If bread is burnt it assumes, according to the scholastic philosophy, a new *forma substantialis* and new accidents. If it is consecrated by a priest it assumes a new substance, namely, that of the body and blood of Christ. Its accidents are unaltered, but they become, it would seem, much more liable to alteration. In particular, consecrated hosts are said to be liable to bleed, as in the case of the miracle of Bolsena. Also the eating of one has (it is alleged) profound effects. If you say that a change of substance and a change of substantial form are so different that no one could classify them together, I shall be delighted to take up the point later. Personally I regard the theory of transubstantiation as a piece of pre-scientific chemistry, and shall continue to do so until you attack that view by argument rather than assertion.

In the same way the theory that a substance called the soul leaves the body at death is widely held. I have never (to my knowledge) stated that it is Catholic doctrine. It is a physiological theory, because it is held that the presence of the soul in the body is responsible for some, if not all, of the phenomena of life. Again, the object which Catholics worship at mass is thought by them to be God. I think that it is a wafer. Not being addicted to masses, whether high or low, black or white, I admit that I may have been wrong in calling it a biscuit. But I am told that it is flat and round, and made of the same materials as certain biscuits, so I do not think that I am very far out.

You object to my not defining what I mean by "absolute" during half an hour's broadcast address. Had Sir John Reith seen fit to accord to persons who do not share his religious opinions one-tenth of the time that he allots to sermons by the clergy, I might have had the opportunity to do so, and your criticism would have been legitimate. By "absolute" I mean independent of circumstances, the opposite of "contingent." Thus if I say that $2\times3=6$, I mean something which is absolutely true, and would be so even if no example existed to demonstrate it, as no example, perhaps, exists to demonstrate that $10^{100}\times10^{100}=10^{200}$. I further believe that it always was true, and always will be. On the other hand, the statement, "No men exceed twelve feet in height," though true at present, might be rendered false by the appearance of such a man. It is a contingent statement. I hope that I have made myself clear.

As I said in my broadcast address, I think that the realities corresponding to certain statements (including $2\times3=6$) constitute an invisible world. Such realities (as I think) do not alter with time, like the things in the visible world. When I used the phrase "invisible world" in the address in question, I was referring to the aggregate of those realities which do not change with time, and I am quite willing to give this as a definition. It corresponds, roughly at least, to what Plato meant by the world of ideas, but his account seems to me unduly metaphorical. As I understand that you believe in the multiplication table, I assume that you also believe in some such absolute and eternal facts. I suspect that this "world" includes moral facts as well as mathematical and physical. But why should you attack me for agreeing with St. Thomas?

As I do not think that I have ever talked or written about a "realm of values," I am not called upon to define it. On the other hand, when I talk about the invisible world I do not, as you assume, mean a supernatural world. The timeless facts which are symbolized by the multiplication table are invisible, but hardly supernatural. And I confess that I do not see that $2\times3=6$ needs an eternal God to conserve it. No doubt a sufficiently powerful being could so affect my brain as to make me believe that $2\times3=7$, but that

would not make the statement true. Nor is $2 \times 3 = 6$ liable to decay, like a house or a mountain, so as to need conservation. Similarly, if (as seems likely to me) there are eternal facts symbolized by "Thou shalt not bear false witness against thy neighbour," or the score of "Die Zauberflöte," I do not see that they need any conservation. Nor did Plato or Aristotle, to go no further.

As for my own opinion of death, I do not know if my works will perish with the solar system. Our descendants may migrate elsewhere. If they have the mathematical knowledge needed for this purpose they will almost certainly possess my solution of the equation $\triangle u_n = k\varphi(u_n)$ among other hoary intellectual relics of the past. I am not myself afraid of death, among other reasons because I have tasted life so fully that I expect to be fairly satisfied when I cease to live. On the other hand, I think most people's lives are too short to give them a chance to fulfil their possibilities as I hope to have done. That does not mean that if, by pressing a button, I could make everyone live a hundred thousand years, I should press it. Premature death is generally an evil. I am not sure that death is so. You see, I do not begin, as you think I should, by asking whether more life is better than less life, but how much more life, if any, is desirable. That is because I often think quantitatively, which Socrates did not. I claim that this habit (for which I deserve no credit, for I did not invent it) allows me sometimes to think more accurately than did Socrates or St. Thomas. But I will concede you a point. My interest in vital statistics is largely a sporting one. No amount of hygiene will make a man live for an infinite number of years, just as no amount of strength or skill could enable him to run an infinite number of yards in a minute. But I like to see records broken, whether in yards or years.

As for the statement which you quote from me as to "the teaching of physiology," I admit that I was using a metaphor. It is physiologists, not physiology, who teach. But it would have been misleading to write "some physiologists" as you suggest. I cannot think of a single living physiologist for whose experimental work I have any great respect who holds the contrary opinion. I therefore think

that my metaphor was legitimate. And though I will try to avoid metaphors in this correspondence, I do not promise to abjure them in my other writings, nor do I apologize for having used them in the past.

Now for your last quotation about the "Great Being." I fear that when I wrote it I was thinking, not about God, but about two Great Beings (mortal gods, as Hobbes termed them) called England and Humanity, of which I am a member. They seem to me (perhaps wrongly) to possess a reality of somewhat the same kind that I do. They may be regarded as fictions or abstractions, but they are not, I think, quite unreal. They are not, I presume, conscious, but neither is a poplar tree, so far as I know. Yet the tree possesses a unity, although we can divide it, and grow the parts separately. There may be Great Beings including Humanity, but I do not know about them. The phrase "Great Being," due to Comte, was probably clearer to my audience than to you. Once again you are annoyed with me because I do not state my reasons for all my speculative opinions.

Had I but world enough, and time

I should be glad to do so, though I do not know how many listeners I should find. Perhaps some day I shall perpetrate a philosophical system. But I have a lot to do, and cannot work for more than ten hours daily. I think, moreover, that the reasoning embodied in some of my scientific and mathematical papers is more solid than any that I could offer on behalf of my philosophical views. If I do not defend these latter in any detail in these letters it will be because I think we had better concentrate on our differences rather than on our agreements. For, after all, you believe much more firmly than I both in the existence of an invisible world and of superhuman beings. But if you really want me to define any term that I have used I will, of course, either try to do so or admit that I was using a metaphor. Please, however, do me the justice to suppose that, at least nine times out of ten, I mean what I say. If you think that I have evaded any of your questions, tell me so, but I feel that we have already covered much paper with the discussion

of trivialities, and had better get down to more fundamental issues, such as the existence of an almighty and morally perfect creator.

Now for a spot of counter-attack. If I do not use as strong language as Mr. Joad, it does not follow that my feelings are any weaker than his. But I realize that if we are to argue (as opposed to slanging one another, which is much easier, and nearly as good fun) we had better avoid invectives. You are generally polite to me personally, but rude to my profession. You say that we make noisy assertions (to be compared with the still, small voices which issue weekly from some tens of thousands of parsons in their pulpits). And you refer to "all that scientific pioneers have had to suffer from the jealousy and obscurantism of organized science." In my opinion they have suffered very little. To begin with, they have not been burned alive by their colleagues, as some of them were at the instigation of the clergy. Sometimes their writings were ignored, as in the case of Mendel. This was generally due to a failure to recognize their importance, rather than to jealousy or obscurantism. Mendel's work did not contradict any firmly and generally held opinion, or cast doubt on the merit of any of his contemporaries. It was just so new that those who read it did not realize its importance.

More rarely an important contribution has been refused publication, as in the case of Waterston's paper on the kinetic theory of gases. This contained several obvious errors, which gave the referee a chance to turn it down. I can sympathize with Waterston, as in two cases I was induced to refrain from publishing important and subsequently verified principles on the ground that my evidence was inadequate. In each case someone else later produced the same theory, based on much better evidence. But I also sympathize with Waterston's referee, because I have acted in this capacity for many scientific papers. And I have turned some of them down, not because they attacked current opinions, but because I thought the evidence in them inadequate to prove their conclusions, or even to make them plausible. I am sure that for every paper wrongly rejected on such grounds dozens are rightly refused, owing

to the smallness of the funds available for publication. No harm whatever came from the rejection of my conclusions referred to above. They were securely established within a few years on much surer foundations than my own.

Perhaps you will care to substantiate your attack on my profession by some detailed examples. Such attacks are often made, and in the course of centuries are doubtless occasionally justified. For scientists are only human beings, and neither passionless nor infallible. But a general accusation of this kind is as ridiculous as Mr. Chesterton's defence of crusades and persecutions in your first paragraph. I wish that some day you would explain Mr. Chesterton to me. In a recent article[1] he remarks: "All men of science have abandoned materialism." Do you think that this sort of statement is due to ignorance or mere laziness? Or is he, like his mediaeval friends, relying on "blind instinct"? In England to-day such a statement of materialism as Hogben's *The Nature of Living Matter*, finds wide acceptance among my colleagues. In Russia the upholders of the official dialectical materialism complain that many of the Russian scientists are too mechanistic. I often have to argue against what I consider the exaggerated materialism of my younger colleagues. And personally I am engaged in examining dialectical materialism as a possible philosophy, and so far find it intellectually attractive, though I have not gone so far as to adopt it. But I certainly think the physical discoveries of the last ten years have made materialism far more plausible than it was in the past.

Now for your attacks on "modern sceptics." Zola and Strauss are not modern. I do not, however, propose to go on with this line of attack, and collect intemperate and inaccurate statements by Christian controversialists. It would be too easy. After all, it is possible that your methods of controversy may be unfair but your basic arguments correct. So I await your proofs of God's existence in your next letter.

Yours sincerely,

J. B. S. HALDANE.

[1] *Illustrated London News*, October 22nd, 1932.

VII.

THE PREJUDICES OF UNBELIEF

SUTTONCROFT,
BICKLEY.
December 14, 1932.

DEAR HALDANE,

I propose to divide this letter into three parts. In the first I shall take up a few minor points and reply to various challenges in your letter. In the second I shall discuss two fundamental issues—your defence of extreme scepticism and your attitude to death. In the third part of this letter I shall clear the ground by defining my real difficulty, the prejudice against which the Christian apologist has to contend and—more serious still—the fact that those who are most strongly biased are unaware of their bias.

First as to the minor points.

(*a*) As I have been at some pains to persuade you that the passage from St. Mark beginning with the operative words, "Go ye into all the world, and preach the gospel to every creature," was addressed to the apostles and referred to their missionary activities; it is rather hard that I should be accused of suggesting that the first and second verses of this passage refer "to different sets of people."

(*b*) "You agree, I take it," you write, "that Jesus rose from the earth's surface. If so, His body either came down again, reached a place called Heaven, or is still moving, or was annihilated. Which alternative do you prefer?"

I believe that the body of Jesus disappeared from the surface of the earth, but, as the Church has never defined the nature of Heaven, I do not feel called upon to supply geographical details. Heaven may be a place or a state. Nobody knows, nobody professes to know. Meanwhile let me remind you that the question as to what happened to the body of Christ is a greater difficulty for you than for me. You will have to supply, at a later stage of this correspondence, some theory to account for the empty tomb, and also some explanation of the absence of a shrine, for, if

the body of Jesus did not leave the earth, the place where His body rested would probably have become a shrine.

It is odd that you, who are so well read in Catholic theology, should betray no acquaintance with all that St. Thomas, among others, has to say on the characteristics of the risen body, and on its relations to time and space.

(*c*) The question of moral responsibility which you raise in connexion with the child suffering from lethargic encephalitis requires a letter to itself. We can go into all that later, if you wish.

(*d*) You challenge me to substantiate my charge that scientific pioneers have often had to suffer from the jealousy and obscurantism of organized science. I should like to devote my next letter to this theme. Meanwhile I will ask you to name a single scientist who has been burnt alive "at the instigation of the clergy."

It is, of course, up to you to prove that such burnings, if they occurred, were due to the unpopularity of the victim's scientific theories.

"You are generally polite to me," you write, "but rude to my profession." I respect both you and your profession. All I claim is that intolerance is not a vice from which scientists are immune. But do, please, believe me when I say that I am perplexed and puzzled by the recurrent suggestion that there can be any quarrel between the Church, which is concerned with supernatural truth, and science, which is concerned with natural truth. The Church of Copernicus, Vesalius, Stensen, Mendel, and Pasteur is only accused of hostility to science by people who are imperfectly informed of the facts.

And now for fundamental issues. The opening pages of your letter confirm my belief that Mr. Chesterton is a true prophet., His wildest paradoxes are coming true. You, an eminent scientist, express your grave regret that "Mr. Chesterton was unduly optimistic in predicting a race too modest to believe in the multiplication table. Such a disbelief would only be temporary, I think, but it would be a very salutary phase."

What *does* this mean? In what conceivable way would it help us to doubt those very truths which elsewhere in

your letter you describe as "absolute"? For more than a century secularists have been contrasting the objective facts of science with the subjective superstitions of religion. "Back to facts" has been the slogan; "Back to truths which we can prove. Sit down before fact like a little child." And now we are gravely lectured on our faith, not in God this time, but in the multiplication table. Why bother to think at all if it is salutary to doubt the very foundations of thought?

What precisely are you getting at? Is the reader expected to contrast the exaggerated humility of the man of science with the dogmatism of the Christian? True, the Englishman instinctively distrusts all dogmas save that corpus of sound doctrine which he imbibes at his public school, and you may be wise to exploit this prejudice, for the man who would be shocked by the heresy of wearing a black tie with tails is the first to condemn the Church for its intolerance of heresies more serious than these sartorial lapses. But only the unsophisticated will be impressed by this parade of sceptical humility, for modesty need not involve the suicide of thought. St. Thomas Aquinas, who filled volumes with the exposition of Catholic dogma, was one of the humblest of men, but humility is not the most marked characteristic of our modern secularists.

I do not think you can fairly claim Descartes as the spiritual father of ultra-scepticism. You will find his real view of the multiplication table in his second rule. I do not believe he ever seriously doubted the absolute truth of arithmetic, and, if he did, subsequent philosophers have not been foolish enough to congratulate him on this feat. After all, Descartes said, "*Cogito ergo sum.*" "I'm not quite certain that there is an 'I' to think," would seem to be your position. You prefer to style yourself an "abstraction." An abstraction of what?

I do not think that either Comte or you have thought out what you mean by personality. Comte's "Great Being" is the result of realism gone mad—I am using "realism" in its philosophic, not its popular, sense. You deny the transubstantiation of the substance of bread, but expect us to accept by faith a "substance" called Humanity. Does

"Humanity" mean all those who have existed and all those who still exist? And does it include the unborn? Has "Humanity" any real relation to human beings? What scientific facts have been discovered to justify your assertion that "Science is very emphatic that such a Great Being may be a fact as real as the individual consciousness"? Is Humanity a "particular" or a "universal"? I think your "Great Being" would have emerged rather the worse for wear after a debate on this bogus universal with Abelard.

This blind faith in a "Great Being," for whose existence in any real sense of the term there is no scrap of evidence, scientific or otherwise, is one of the penalties which you pay for your excessive scepticism.

You tell me that you feel as strongly as Mr. Joad on the subject of Christianity. But why should you entertain any feelings, strong or weak, until you have made up your mind that there is a "you" to feel strongly? Again, if it be true, which it certainly is not, that "our ideas about most, if not all, things are self-contradictory," why lecture the poor Christian on what you believe to be the inconsistencies of his position? Your own are admittedly no better. Indeed, why bother to discuss or to think at all if you have so poor an opinion of the possibilities of human thinking?

Life is impossible, science is impossible, without an act of faith. What value can you attach to a scientific experiment if you really believe that most, if not all, of your ideas are self-contradictory? Science would be impossible unless men assumed that the universe was rational. Faith is the necessary prelude to all research. Your own career proves that you do not take these delicate doubts very seriously. I entirely disagree with you that such doubts are salutary. Indeed, I regard this ultra-scepticism as the solvent not only of religion but of science, philosophy, and rational thought. A world which took you at your word would be a world which had condemned itself to extinction.

And now for the second great issue which you raise in your letter—death and our attitude to death.

It is not the disbelief in immortality that I criticize, but the conviction that it is "selfish" to desire immortality.

Those who lecture us on desiring the survival of our petty personalities do not seem to be less interested in their own personalities than, say, St. Francis. You say that you are not afraid of death, and my belief that this statement is sincere is, like my belief in Christianity, the result of reasoned deduction from the evidence.[1] But I still maintain that your attitude to immortality is irrational.

Now for a spot of science. As an amateur psychologist I suggest that the process whereby you have convinced yourself that death does not matter is not a rational process, but the process which psychologists describe as "rationalization." You believe that you are mortal, and you have contrived to discover reasons to convince yourself that mortality does not matter. Your attempt to console yourself by the reflection that humanity is not necessarily mortal, and that our remote descendants, having emigrated to some other solar system, may still enjoy the fruits of your solution to the equation $\triangle n_m = kcp(m_n)$, is an example of the law of compensation, a law to which certain psychologists foolishly attribute the belief in heaven.

Well, I am old-fashioned enough to believe that arguments must be met by arguments and not by an analysis of the motives which induce Smith to hold Smith's views; so I will cease trying to diagnose you, and will proceed to criticize the reasons you adduce to fortify your belief that death does not matter.

You say that you expect to be fairly satisfied when you die because you have tasted life so fully. How odd! I have not had a dull life, and for that very reason I deplore the shortness of life. I have only scratched the surface of knowledge. If I lived to be a thousand I might find time to read all the books which are worth reading, all those that have so far been written, but I should still be haunted by the knowledge that I had only skimmed the cream off the good books which will be written in the next millennium. I have been looking at pictures all my life, and am only just beginning to appreciate the majesty of Michelangelo's line. If among a man's possibilities, which you seem to think can be satisfied in a normal life, you include the

[1] See *Flight from Reason*, p. 174

possibilities of aesthetic pleasure, how can you suggest that three score years and ten is long enough for their development? On the physical side I am already too old to climb a Himalayan giant. There are scores of great mountain ranges which I shall never see, much less explore; and if I lived to be a thousand I should not have exhausted the glories of the Alpine Spring.

> And, since to look at things in bloom
> Fifty years is little room,

I should be glad of five thousand, nay, five million, years, sure in the knowledge that no repetition could possibly stale the miracle of May. I should indeed be depressed by the awful brevity of life, if I was not persuaded that death is nothing more than a bridge between two modes of existence. And surely if God offered you a thousand years of eager intellectual activity, you would not reject the boon on the ground that you are quite content to die at eighty because some part of your work would survive you?

By way of preface to what follows a word of personal explanation is necessary. In this correspondence we are concerned with the fundamental differences between Christianity and secularism and not with the minor differences between various Christian Churches. In my correspondence with Mr. Joad I had the worst of both worlds, for I did not run away from the difficulties of the Catholic position, and consequently was not free to disown, say, the Inquisition. In addition I was expected to reply to Mr. Joad's animadversions on the Church of England.

In this correspondence I propose to defend the Catholic interpretation of such doctrines as you may select for attack. I am not, as yet, a Catholic, or even "under instruction," and your arguments may keep me out of the Church. Whatever be the result, I do not think I shall alter my view that the difference between a Catholic and an Anglican who is orthodox on the Incarnation is unimportant compared to the difference between those who believe in the Incarnation and those who do not.

And I hope that if I do become a Catholic I shall still be

able to co-operate with all those who in this country and elsewhere are defending the basic doctrines of Christianity. And it is in defence of the beliefs which are common to all Christians that I have entered this discussion.

Having defined my position, I will now return to my criticism of yours. I share your anxiety to prevent this correspondence from developing into a "slanging match," and I see no reason why it should. I propose to criticize your recent book, *The Inequality of Man*, which I have read with the liveliest of interest; but I do so, not because I am anxious to make debating points at your expense, but because your book is a useful peg on which to hang a general criticism of the attitude of secularists to the Church.

Christians believe that the argument between the Christian and the non-Christian resolves itself into a duel between reason and prejudice. The case for the Church, we believe, is so strong that any man will be convinced who approaches this problem with an unprejudiced mind. But how few do! Many years ago I wrote a book called *Roman Converts*. I should have been irritated then, as you may, perhaps, be irritated now, to be accused of prejudice. I had taken a great deal of trouble to get my facts right. I was not accused of obvious mistakes about Catholic doctrines, and yet I missed the whole point, just as you seem to me to have missed the point.

I admit that you are exceptionally placed to form an unbiased verdict. You have been trained in two great schools—philosophy and science. You have some acquaintance with Catholic literature, and you are not consciously unfair.

Your failure, then, to understand the Christian point of view cannot be ascribed either to ignorance or to bad faith, and must therefore be attributed to ingrained prejudice. You seem to start from the premise that this great philosophy, which has attracted many of the master minds of our race, is a puerile collection of absurdities. Like most of your contemporaries, you approach this problem with a mind firmly closed to the possibility that Christianity may be true.

Professor Whitehead is one of the few non-Catholic

scientists in this country who have any sympathetic understanding of Catholic philosophy.

I do not want to make capital out of small points. I will therefore mention only two minor errors on points of fact which could not, I think, have been made by anybody who understood the Catholic outlook. St. Ambrose "became" a bishop when he was consecrated, not when he was offered the bishopric. A Catholic would realize instinctively that an unbaptized bishop is an impossibility. Again, Catholics do not regard "celibacy" as a pre-requisite of sanctity, as you would know if you understood the Catholic view of sanctity. These are minor points. More interesting is your failure to understand the Catholic attitude to authority and to the interpretation of the Bible, and your inability to realize what Catholics believe about transubstantiation.

To begin with, the Church claims to found its case on reason. The Catholic believes that he can produce reasoned and convincing, if not coercive, arguments in support of his belief that God exists, that Christ was God, and that Christ founded a Church with authority to teach in His name. The Church also proposes for his acceptance certain truths, such as the doctrine of the Trinity, which unaided human reason could never have discovered. It is not, however, irrational to accept these truths on the authority of the Church, provided that you can prove by reason that the Church is infallible.

The individual Catholic accepts as proven the doctrines which the Church has defined as true, but few non-Catholics realize how wide is the area open to discussion among Catholics. There is a far greater economy of definition in the Church than you seem to realize.

When, for instance, the controversy about evolution broke over Europe, the Church maintained an attitude of cautious reserve. The Church has seen too many scientific fashions rise and disappear to allow the latest scientific hypothesis to be taught in her name before it has been thoroughly examined. The Church never condemned the theory of evolution, and to-day the theory of the evolution of lower animals may be taught as a "probable hypothesis." So far

as the evolution of man's body is concerned, the Church says that nobody may teach this theory in her name, but that the individual Catholic is free to hold this belief and to work for its establishment, if he wishes, by discussion and research.

There is an old saying that it is not the business of the Church to teach men how the heavens go, but to teach men how to go to heaven. The Church makes no claim to infallibility in scientific matters, but the views of churchmen on scientific matters naturally reflect those of their age.

The Church is slow to define and slow to censure, and the fact that a particular statement has not been censured no more proves that the Church made that statement her own than the fact that a particular doctrine has not been defined proves that the doctrine in question is heretical. You quote some naïve remarks by a mediaeval writer, and add a sentence which shows that you misconceive the Church's defining claims. "That is where," you write, "in the opinion of many mediaeval writers, who were not censured by the Church, your argument leads." You could produce a catena of statements by mediaeval writers who were not censured by the Church, but which no modern Catholic would accept.

Your remarks about the Bible show a similar failure to appreciate the Catholic point of view. The Church claims that her credentials can be proved from certain books in the Bible, treating them as purely human documents. The Bible itself consists of a series of books selected by the Catholic Church—books which the Catholic Church claims the right to interpret. It is for the Church to say where the Bible records objective fact and where the Bible uses metaphor and allegory, and on such points theologians differ and will differ from age to age. When the Biblical Commission, for instance, lays down certain rules for the interpretation of the first chapter of Genesis, all we can say is that the views of that Commission represent the views which, in the opinion of the Church, may safely be taught at the present moment. A future commission may take a different line.

And now for your remarks about the creeds. I read your

statement about the provisional nature of your own beliefs as applying to your own confession of faith. I did not suppose that you intended these remarks to qualify your curt contempt for the creeds of other people. Nor do I think you can escape the charge of injustice to the Church merely because you began with a statement about the provisional character of your convictions. If, for instance, that statement had been followed by the assertion that the Wells-Huxley *Science of Life* was "full of obsolete science" —which of course it is not—I do not think that Mr. Wells would have been much consoled by the defence that the listeners-in to this broadcast talk had been warned that all your views were provisional, and consequently could not have been misled.

Your defence of your attack on the creeds is unconvincing. Genesis is *not* a creed, and your allusions to Genesis have, therefore, strictly no relevance to the question as to whether the creeds are full of obsolete science. The problem as to how far Genesis is allegory, and how far fact, is still debated among Catholic theologians: there is no defined doctrine on this point. From the earliest of Christian times simple believers have thought of the heavens as solid, and have interpreted literally metaphorical statements, such as "at the right hand of God," but there have never lacked theologians to emphasize the difference between metaphor and fact. Thus St. Jerome, commenting on "foolish talking" (Ephes. v. 4), cites as an illustration of such nonsense the fact that some Christians are foolish enough to believe that "Heaven is curved like an arch and that a throne is placed in Heaven, and that God sits upon it, and that, as if he were a commander or judge, the angels stand round to obey his commands and to be sent on different missions."

St. Thomas Aquinas underlines the warning. "When scripture speaks," he writes, "of God's arm, the literal sense is not that God has such a member, but only what he signifies by this member, namely, operative power . . . the very hiding of truth in figures is useful for the exercise of thoughtful minds, and as a defence against the ridicule of the impious, according to the words 'give not that which is holy to the dogs.' "

Controversy is tiresome if neither side is prepared to concede an obvious point. I therefore concede that Mr. Belloc was mistaken when he tentatively suggested that you had confused the Immaculate Conception with the Virgin Birth, and that I should not have assumed that your failure to protest against this criticism justified me in repeating the charge. I expect in return that you will concede the point that you were wrong in stating that the creeds are full of obsolete science, a mistake which was an unconscious inheritance from your remote Protestant past. Literalism is a Protestant, not a Catholic, failing.

One small point. Neither Strauss nor Zola, so far as I know, qualified their remarks by any operative sentence at the beginning of their books as an antidote to the dogmatism of their later expression. They were both prepared to stand firmly by what they wrote. They were not, as you correctly remark, modern sceptics.

I am not particularly surprised by your failure to understand the Catholic attitude to the Bible, and, in particular, to "Literalism," for few non-Catholics are aware that these rather elementary problems have been discussed from the earliest times; but I am frankly puzzled by your remarks about transubstantiation. Surely the whole point about transubstantiation is that it is not a change of form but of substance. Why do you persist in maintaining that transubstantiation is supposed to effect a chemical change? Surely a scientist who in certain moods affects such impressive humility can confess to an error in a branch of knowledge which is outside his normal line of research? You needn't worry. I dare say I shall make worse howlers when I begin to criticize Darwinism, though, in point of fact, at the time of writing no such patent howlers have been brought home to me. But as you apparently expect argument and resent assertion on what is, however, a simple question of fact, let me suggest that though Catholics attribute "profound effects to eating" a wafer, these effects are not, as you imply, ascribed to any chemical change in the consecrated elements. What do you make of this case? Two Catholics communicate. The first is in a state of mortal sin. The second has been absolved. The chemical constituents of

the wafer are the same in both cases, and yet Catholics hold that the "profound effect of eating" the wafer are profoundly different in these two cases.

As to "bleeding hosts," it is no part of defined doctrine to believe in bleeding hosts; but if some such case could be authenticated, what would it prove? That transubstantiation is a chemical process because the host sometimes bleeds? No, but that two miracles had taken place: first the non-chemical miracle of transubstantiation; secondly, a gratuitous and additional miracle which might or might not produce a chemical change in the consecrated wafer.

But really you might allow the unfortunate Catholic to know what Catholics believe about transubstantiation. Whether transubstantiation takes place is a matter of opinion on which you are entitled to your view. Whether Catholics believe that transubstantiation involves a chemical change is a question of fact on which you are wrong and on which I am right. I shall only be prepared to qualify the curt dogmatism of this statement when you can produce in your support a recognized Catholic theologian who believes in a chemical change of accidents rather than in a non-chemical change of the substance.

Froude, who hated Catholicism, had sufficient imagination to write an admirable essay on Catholic philosophy. You are content to poke fun at the sacraments, for I do not think that the following passage really represents your considered views. "If to-day," you write, "we find it difficult to imagine how so much emotion could gather round the act of eating, we must remember that the majority of Christians were so poor that they had first-hand experience of hunger. To most of them food must have presented itself, not as a source of mildly pleasant sensations, but vividly as a life-giver."

Et adversum ecclesiam tu tam minute jacularis?

You are an adept at representing men whom Catholics revere in a slightly ridiculous light. You do not allow your reader to suspect the grandeur of that great scene when St. Ambrose held the Arians at bay—the occasion to which we owe that noble hymn the *Te Deum*. St. Ambrose emerges without distinction from your slight sketch, though you salve

your historical conscience by two compliments. St. Thomas Aquinas, again, is regarded as one of the greatest intellects and greatest saints in the Catholic Church. In a few deft touches you make him ridiculous: "St. Thomas, it is said, was one of the fattest men who ever lived, and in his latter years could carry out the ritual of the Mass only at a specially constructed concave altar." I do not know where you collected that legend, but one who is both a scientist and a mathematician should be able to calculate the waist measurement which would be necessary to prevent St. Thomas reaching the altar with his hands. Five seconds' thought disposes of this legend. Perhaps you have read Peter Calo's life which appeared in 1300. He tells us that St. Thomas's features corresponded with the nobility of his soul, that he was tall and of heavy build, but straight and well proportioned. Francesca's portrait at Milan confirms this impression.

Your remarks about St. Thomas occur in an essay on "god-making," an essay which is largely taken up with a discussion of transubstantiation.

A reviewer in *The Times Literary Supplement*, in the course of a discerning and friendly criticism of this book, remarked that your "animadversions on religion will cause much pain." I was not pained, only puzzled that so much reading of Catholic literature could produce so little understanding of the Catholic point of view. And I think that the clue not only to your attitude, but also to that of the intelligentsia is to be found in one revealing sentence. "I find religions an absorbing topic," you write. "The intellectual side of this effort interests me mainly because of its fantastic character. The stories of how hundreds of millions of the people came to believe in the immaculate conception, the uncreated Koran, or the spiritual advantages of bathing in the Ganges are fascinating both as history and psychology."

If your object be to suggest that Catholicism is only of interest to the psychologist, you have succeeded in conveying that impression of the learned man relaxing after a hard day's work in the laboratory! Feet on the fender, he dips into some weird Catholic work, and an indulgent smile steals over his lips as he muses on the rum beliefs of misguided

men. Yes, you could not convey more cleverly that attitude of indulgent superiority which is so much more effective than mere argument.

I pay you the compliment of assuming that there are moments when you suspect the true scale of Catholic philosophy. The mere fact that you, a busy man, have agreed to debate these great issues is proof that you consider them worth debating. And I should be only too happy if, as the result of this correspondence, I had contrived to persuade you that it shows a certain failure of perception to bracket in the same sentence the doctrines of Catholicism and Hinduism.

Yours ever,
ARNOLD LUNN.

VIII.

DOUBT AND DEATH

January 5, 1933.

DEAR LUNN,

How unfortunate it is that a reading of *The Inequality of Man* has diverted you from your exposition of the arguments for the existence of God. I venture to suggest that some of the statements in that book to which you object, for example, the alleged corpulence of St. Thomas, are irrelevant to the large issues which (as I had hoped) we were going to discuss. So I shall not deal with them further unless you can show me their importance.

But I must thank you for pointing out my mistake regarding St. Ambrose. He was offered a bishopric before he was baptized (a striking occurrence, as you will admit), but his baptism was doubtless a necessary preliminary to his consecration. The mistake is similar to that made when one describes a person as an M.P. after his election but before he has taken his seat. Worse mistakes have been made. Indeed, I have found some which seem to me quite as bad in your letters to Mr. Joad, for a copy of which I thank you. I must also thank you for withdrawing your accusation about the Immaculate Conception. I have no idea where Mr. Belloc made the statement to which you refer. I have never seen it. But I hope it will be a lesson to you not to take Mr. Belloc's statements any more seriously than I do.

But whilst I thank you for a correction of one mistake and an admission of another, I must really protest when you say that I "approach the problem with a mind firmly closed to the possibility that Christianity may be true." What do you know about it? I want to suggest that assertions of this kind will serve no useful purpose.

The statement quoted in my last letter about the provisional nature of my opinions does not suggest firm mental closure. The fact that Christians rarely, and the clergy, so far as I know, never, make statements of this kind suggests

closure on their part. Actually I think that the logical scheme of official Catholic philosophy is a sound one in so far as it demands that the existence of God should be proved before the detailed evidence for the truth of Christianity is considered. I therefore confine my thought in the main to examining the former of these two hypotheses. I do not suppose that, on the average, I devote much more than half an hour per day to meditating on the structure of the universe (which includes, or does not include, a personal creator). Had I more faith in my logical powers I should devote more time. But I venture to doubt whether the average Christian devotes quite so much.

If I became convinced of the existence of God I should then have to consider which, if any, of the theistic religions was true. I should very possibly plump for Judaism or Islam. I assume that you have not closed your mind firmly to the claims of Muhammad to be a messenger of God, and that you occasionally find time to read the propaganda of such bodies as the "Anjuman i isha'at i islam."

But your remarks about Hinduism in the last paragraph might, to a superficial reader at least, suggest (if the idea were not absurd) a partial mental closure on your part. For example, while I admire the scholastic philosophy as an intellectual effort, it appears to me to be on a lower intellectual level than either the Samkhya or the Advaita Vedanta philosophy as expounded by Isvarakrishna and Samkara Acharya respectively. I think that it would be a very high compliment to St. Thomas (or anyone else) to bracket him with Samkara Acharya. Doubtless, however, I am doing you an injustice, and you could give cogent reasons (for in the last sentence of your letter you speak of persuasion) for preferring Thomism to each of the *astika* schools of Indian philosophy, any one of which may be regarded as a doctrine of Hinduism in the same way as (since Leo XIII's encyclical of 1879) Thomism may be regarded as Catholic doctrine. But you must not expect me—or our readers—to take these for granted. And please do not present me with an account of Hindu doctrine as compiled by a non-Hindu from an examination of Hindu villagers. After all, a Sicilian peasant, as reported by an

intelligent Indian, might not give a very coherent or attractive account of Catholic belief.

Seriously, would it not be better if you ceased to take things for granted, either about me or about non-Christian religions?

You clearly object to my poking fun at Catholic dogmas, and are puzzled, so you write, at my misunderstanding the Catholic point of view. Has it not occurred to you that a person might understand it and still find it objectionable? I have made a certain study of the Catholic Church by discussion with Catholics, reading of Catholic literature, and observation of Catholic ceremonies and conduct, and have come to the conclusion that the Church is an evil. For this reason I consider it legitimate to use ridicule as a weapon against it. In this respect I am a humble follower of Voltaire.

I cannot give all my reasons for objecting to the Church. Mr. Joad has given some of them. But why call this objection a prejudice? A prejudice is an objection not based on knowledge. My objection is so based, even if the knowledge (like all knowledge of concrete things) is incomplete. So much the worse for me if you are right. I am not likely to escape hell fire on a plea of invincible ignorance. In your correspondence with Joad you have given a summary of one of my grounds for objection. The Church, you say, is perpetually at war. Quite so. Like a warring State it uses violence when it can, atrocity stories, sobstuff, and threats when it can't. You must not expect non-members to feel the respect for it which they may feel for less warlike religious bodies such as the Society of Friends, or Jewry.

Now for your main objections. You think that scepticism is a bad thing, and that it is rational to be afraid of death unless you think that you are going on to a happier life. I, on the other hand, think that it does help us to try to doubt truths which appear to us to be absolute. Sometimes the doubt is extremely fruitful, as when a refusal to believe in Euclid's parallel postulate led to the non-Euclidean geometries. Sometimes the doubt seems to lead nowhere. But very often it enables us to dig down a stage deeper in our examination of reality. If you think "the multiplication

table is obviously true, and that's that," you are unlikely to go far in your examining the foundations of mathematics. If you think "the multiplication table is a complex theory which stands in need of justification" you may be able to lay bare unexpected assumptions. And this process may be of great value in dealing with mathematical problems of a more advanced kind, such as the properties of infinite classes (e.g. all numbers). These problems are of importance in such practical questions as the design of transcontinental telephones. If you honestly think that a critical examination of mathematical principles which are apparently obvious is "the suicide of thought," you might dip into *Principia mathematica.*

As, however, you are so contemptuous of the sceptical method, which is part of the general method of science, let me try to make certain points clear.

Doubt does not involve a suspension of action. Napoleon planned each of his battles on a certain hypothesis as to the enemy's dispositions. As he only regarded it as a hypothesis he was able to modify it, and his plan with it, in the light of later information. His opponents generally had more faith than he. In consequence they engaged their reserves prematurely, and were beaten.

Doubt does not involve intellectual suicide, but intellectual modesty. Various propositions seem to me to be true, but I admit that I may be mistaken, and am almost certainly mistaken in part. This is mainly because propositions are made in words, and words are not things, but symbolize them more or less inadequately. Plato, Hegel, Marx, and Lenin, to mention no others, have held that our notions about things contain an element of self-contradiction. I happen to agree with them, and to hold that scientific and social progress depend to a large extent on our laying these contradictions bare, and transcending them. You will find a similar point of view, put less metaphysically, very ably developed in Levy's recent book *The Universe of Science.*

Your views on feelings are curious. "But why," you ask, "should you entertain feelings, strong or weak, until you have made up your mind that there is a 'you' to feel

strongly?" Well, judging from my mother's account, I did entertain strong feelings, including stomach-aches, some time before I had begun to reflect on the nature of the soul. Actually I think "you" are something like London. Your boundaries are arbitrarily drawn and somewhat fictitious. For one purpose London is the City, for another the County, for yet another the Metropolitan police area, and so on. So with a man, as I pointed out in my last letter. Some feelings about the Catholic Church, a perception of this sheet of paper, and other facts of consciousness cohere in a rather inadequate manner in a "transitory and hazardous" system called J. B. S. Haldane. But are they part of the real "I," or are they objects of which "I" am conscious? Either view involves grave difficulties, which I certainly have not overcome. Meanwhile, however, one must use ordinary language, such as "I have feelings." I use it with the full knowledge that it will not bear complete analysis, but also in the hope that you will roughly understand what I mean, though my words symbolize it inadequately.

You have joined the ranks of the outsiders who tell us scientists how we ought to do our jobs. You tell us that "faith is the necessary prelude to all research." It can equally well be said that doubt is the necessary prelude of all research. In the course of a research I may be deceived by the performance of my balance, my measure, my watch, my reagents, or my own reasoning powers. Of these the last is by far the hardest to check. No doubt in research one requires a certain amount of faith in these instruments, but it must not be a very strong faith.

The problem is, as might be expected, a quantitative one. "How much faith and how much doubt do we need in a given piece of scientific work?" We should not test our balance between each weighing, but we should certainly test it from time to time. We should not deny our reasoning powers, but we should check them by experiment whenever possible as well as utilizing the criticism of our colleagues. Certainly we should be very wary of erecting such vast intellectual structures unsupported by experimental tests as are to be seen in the great philosophies.

Now I have some experience of research, and am not a complete fool in ordinary life. And I am convinced that a good deal more doubt, and less faith, is needed in research than in everyday affairs. You describe this attitude as exaggerated humility. I am guilty of it. Let me quote the concluding sentence of my last scientific paper (in the *American Naturalist*): "But just because the theories put forward are in some degree intellectually satisfying, it is important that they should not be accepted without stringent examination." You see, I distrust my reasoning powers because bitter experience has shown me that my most logical theories are often wrecked by horrid little facts.

I want to make one matter clear. Scepticism about theories such as are embodied in ordinary language is a different thing from scepticism about the objects of religion. My fountain-pen may consist of particles, wave packets, ideas in the mind of God, elementary spiritual beings, embodied universals, or what not. But it is a reality. The phrase "my fountain-pen" symbolizes something. But I am unconvinced that the word "God" symbolizes anything. Not only are many statements about God self-contradictory, but they may not refer to anything but aspirations.

One last point before we leave my scepticism. "Science," you say, "would be impossible unless men assumed that the universe was rational." What does this mean? I know what an irrational man is like. What would an irrational universe be like? Personally, I think that the universe is somewhat irrational. It includes irrational men and many things which are even less rational. What evidence have you that the whole is more rational than its parts? Actually, I think that your meaning could be put in the much more modest proposition: "Science would be impossible unless men assumed that they can reason about what they perceive." I wish to caution you against the familiar theological trick of ascribing human characters to the universe.

Now as to death. The theory which you criticize, that the desire for immortality is selfish, has a measure of truth.

I am inclined to think that the average person is distinctly more worried by the thought of his or her own death than of that of others. Moreover, the less selfish you become—that is to say, the more you are interested in matters which will not necessarily end with your death—the less that event troubles you. Hence I am inclined to agree with those whom you criticize that the desire for immortality is mainly selfish, and with you that it is not wholly so.

You suggest that the reasons I give for not being particularly afraid of death are rationalizations and describe the use of this word as "a spot of science." I do not think that psychoanalysis can be described as scientific. Its methods are not those of science. If Freud is right, he reached correct conclusions by insight and imagination, literary rather than scientific methods. And please note that in "Beyond the pleasure principle" he claims that we have a usually repressed longing for death. Perhaps the fear of death is partly a rationalization of the social pressure to overcome this longing. These psychological arguments are two-edged weapons! But, as you point out, they have no bearing on the question of human survival.

Like so many Christian apologists, you are annoyed by infidels who do not think or act as badly as you suppose that they should, just as communists are said to be particularly worried by capitalists who actually treat their employees like human beings. Mr Chesterton has admirably expressed his inability to understand

> Those who do not have the faith, and will not have the fun,

an inability which is natural enough in view of his other opinions. Fortunately for your peace of mind we modern infidels, unlike our grandparents, often go in unashamedly for a good deal of sexual fun which you can conscientiously condemn. But I quite see your point. Your religion, especially as expounded by St. Paul, is largely based on the fear of death, from which it delivers some (I think a minority) of its believers. If we are not afraid of death one great motive for adopting Christianity disappears.

Now I think that my death will probably be the end of

me, as an individual. If so, fear of death is, quite literally, fear of nothing. Alternatively, I shall continue to live, and, as I do not believe in your God, I do not believe in eternal hell, though my future life may contain a good deal of unpleasantness. But I am not particularly afraid of it, and the envisaged possibility of my survival will, I hope, add an interest to the process of dying which it would otherwise lack.

In some primitive races the fear of death seems to be slight. During the last few thousand years it appears to have increased, perhaps with the growth of self-consciousness. Now I think that it is diminishing in individuals like myself, whose main interest is in co-operative work. I take no credit for my sentiments on the subject. They are largely due to my war experience. To enjoy any peace of mind at the front it was necessary to overcome the fear of death to a considerable extent. It was also possible, given my intellectual background, and the habit has stuck.

Let us now consider my damnable errors concerning Catholic doctrine. I wrote that in the Catholic Church celibacy has long been considered a prerequisite of sanctity. I am quite aware that this is not a formal doctrine. But you will remember that the Council of Trent pronounced, "If anyone shall say that the state of marriage is to be preferred to the state of virginity or celibacy, and that it is not better and more blessed to remain in virginity or celibacy than to be joined in matrimony, let him be anathema." Since that time few, if any, married persons have become saints. Indeed, I should be glad if you would tell me of half a dozen persons living later than 1600 who have been canonized, and who were not living celibate lives at the time of their deaths. I cannot think of a single one, but I am no hagiologist. You will admit their extreme rarity. If none can be found, I shall have made my point.

I am afraid that I still regard transubstantiation as a chemical doctrine. Thus sugar may be converted into alcohol by yeast or its enzymes. That is a matter of ordinary chemistry. Water may (it is alleged) be converted into wine. That is miraculous chemistry. A wafer is said

to be converted into the body and blood of Christ. That is miraculous chemistry too. There is, in fact, a double miracle, because its accidents (appearance and so on) are not changed with its substance. I am perfectly aware that according to the philosophy of St. Thomas a chemical change is only a change of *forma substantialis*. But then I do not agree with his philosophy. And until you have convinced me of it I shall continue to hold my view. Again, the fact that a consecrated wafer is said to have different effects according as the eater is or is not in a state of mortal sin reminds me of the different effects of eating an egg according as the eater is or is not sensitized to egg albumen—a matter of bio-chemistry.

As far as I can make out (for I may have misunderstood you) you want me to take the statement that Jesus ascended into heaven, and sits at the right hand of God, as a metaphor. What a pity that this is not more clearly explained to most of the hundreds of millions who recite the creeds? And how careful one must be not to push the thing a little further, and regard the paternity of God and the virginity of Mary as metaphors, like God's arm. I append a nice creed for modernists constructed on these lines:

"I rather feel that there is a First Cause of heaven and earth, and that Jesus Christ, our Example, was related to It in a special manner. He was conceived in holiness, born of Mary (a particularly pure woman), suffered under Pontius Pilate, was crucified, dead, and buried. On the third day, in spite of his death, his work was carried on. He became part of the cosmic scheme and was united with the First Cause. He is an example by which the quick and the dead may be judged. I believe in holiness of spirit, the holy universal church, the fellowship of good men, the forgiveness of mistakes, and the persistence of our ideals after our death."

You are on a slippery slope. I am quite willing to concede the truth of the resurrection if I may interpret it as a metaphor, as some modernists do. For future argument, however, I should be glad to know just how much of the creeds are to be taken metaphorically in your opinion. This will save me from wasting much good ink. But please do

not assume that I shall have to account for the "empty tomb" until you have proved its existence.

Your remarks about Comte's "Great Being" are odd. I have no "blind" faith in it, nor have I asked anyone else to accept it by faith. I have suggested that it may possibly exist, as xenon fluoride or a virus responsible for cancer may exist. I have no faith, blind or otherwise, in any of the three, but regard them as possibilities. Your question as to scientific facts justifying my assertion about it would have been mainly answered had you quoted that assertion completely, as you did in an earlier letter. It would then have been plain that I emphasized no such facts. The main facts are briefly as follows. Cells from a brain can be grown in tissue culture where they live a Robinson Crusoe-like existence. Their life does not depend on their being part of a larger whole. When they are aggregated in a certain way, consciousness and integrated behaviour occur. Hence there is nothing (to my mind) unreasonable in the speculations of Comte or MacDougall that human individuals may be constitutive of a being of a higher order. But this is emphatically not part of my creed, and if it were disproved I do not see that it would at all weaken my case for secularism. So I am not going to state the arguments in its favour, suggestive but I think inconclusive, which may be found in such a book as MacDougall's *The Group Mind.* MacDougall believes in the immortality of the soul, which I don't, and if you were to succeed in proving that a belief in "Humanity" was the result of "realism gone mad," you would incidentally cast some doubt on certain of the mediaeval arguments concerning the individual soul.

Now for two minor points. I did not, as you state, accuse you of suggesting that the two consecutive sentences from St. Mark referred to different sets of people. I gave you the choice between that and holding that they only referred to the apostles' audiences, and not to later generations. You apparently accept the view that "He that believeth and is baptized shall be saved . . ." has no validity except for the apostles' hearers. You are on another slippery slope here. How many more of Jesus' reported sayings were addressed only to His hearers and not to later

generations? There are great opportunities for modernism along this line too!

I hope that my next letter will be shorter, but I could hardly have shortened this one without appearing to give way on certain points.

Yours sincerely,
J. B. S. HALDANE.

IX.

SCIENTIFIC INTOLERANCE

Palace Hotel des Alpes,
Mürren.
24 *January*, 1933.

Dear Haldane,

I am not, as you seem to think, in the least perturbed by the jokes made against the Church, nor by the fun which you have poked at Catholic doctrine. You describe yourself as a humble follower of Voltaire. Follower perhaps; humble, hardly. Christians often complain that the Church has no great enemy to-day of Voltaire's calibre. Certainly our own pinchbeck Voltaires have not produced one book between them which will live as Voltaire's *Dictionary*, best of bedside books, will live.

Ridicule is, of course, a valuable and legitimate weapon, but a writer who uses no other weapon, and who makes no attempt to attack the Church where it is strongest, must not wonder if his less instructed readers come to the conclusion that he may find it easier to poke fun at St. Thomas's fatness than to refute his philosophy; easier to sneer at Mr. Belloc than to prove him wrong. I who know that you are itching to deal with the Aquinate proofs of God's existence—you shall have them in due course—am under no such illusion.

You object to my statement that your mind is closed to the possibility that Christianity may be true. But surely it is not unreasonable to suggest that a man who recalls with satisfaction the fact that he was not brought up in the tenets of any religion, and who admits that he regards the Church as an evil, has made up his mind that Christianity is false. If it is permissible for you to suggest, as you have done, that I take my beliefs for granted, why is it impolite for me to imply that you take your unbelief for granted? If I have imputed prejudice to you, you have imputed prejudice to me; see, for instance, your reference to Strauss on page 42.

The superiority of the non-Christian creeds had to come into this discussion sooner or later. For myself, the more I study other religions the more I am impressed by the

uniqueness of Christianity. I have read the Koran, a dreary, uninspiring work. As to Hinduism, I find it difficult to take Hinduism seriously, because I have an insular prejudice against that diet of cow-dung and urine which the pious Hindus regard as particularly holy. Hinduism, as you yourself remark, "has excused every kind of evil, from murder and the prostitution of young girls to self-mutilation and refusal to wash. It is, moreover, the chief prop of a system of hereditary class distinctions based in part on differences of colour, by contrast with which Louis XIV appears an equalitarian and Pizarro a champion of racial equality. And I find many of its myths disgusting."

So if you accuse me of "a partial mental closure," so far as Hinduism is concerned, I shall not attack the statement as either reckless or impolite. On the contrary, I shall welcome it as a tribute to my common sense.

In your eloquent defence of scepticism you are preaching to the converted. It is not the scepticism of the moderns which irritates me; it is their distressing credulity. It has been well said that the average Londoner of to-day believes far more things on authority than did any of his ancestors. I am bringing up my own children to doubt anything which they see in print, particularly all pronouncements of popular scientists.

But although the habit of doubt was never more valuable than it is to-day, there are some things, such as the multiplication table, which it is idiotic to doubt. You mention Euclid's parallel postulate. That postulate remains as true to-day as when Euclid formulated it. Much loose nonsense has been written to the effect that Euclid has been superseded, and the man in the street is encouraged to believe that Einstein has shown up the great Greek. That is nonsense. Euclidean geometry remains absolutely true for Euclidean space. If, however, our space is curved, certain propositions of Euclid's would not apply to our space, as Euclid would have been the first to admit, but there is no more reason to-day than there was in Euclid's time to doubt the parallel postulate so far as Euclidean space is concerned.

You refer to the "familiar theological trick" of ascribing human characters to the universe. You are mistaken. It is

scientists, especially atheistic scientists, who personify nature, or who, like Mr. Wells and Mr. Joad, personify "life." Why should you accuse me of ascribing "human characters" to the universe merely because I believe that the universe is rational? By a "rational universe" I mean very much what Newman meant when he said, "We are sure that there is an external world, that it is a system with parts and a whole, a universe carried out by laws."

In spite of my impatience to get on with my job, there are several points in your last letter which I cannot leave unanswered. I repeat that it is for Catholics to define what Catholics believe, and for non-Catholics to argue that the belief in question is false. No Catholic theologian asserts that transubstantiation affects the accidents, which alone are capable of chemical change. I suggest that you apply the sceptical methods, which you value so highly, to the proposition "Professor Haldane alone knows what Catholic theologians believe." But perhaps the doubt which is so fruitful when applied to the multiplication table is disedifying when applied to your pronouncements on Catholic theology.

In this connexion may I make a small protest? We Christians are rather fussy about terminology. Vagueness and slipshod definition are greater crimes in theology than in science, because theology is so much more important than science. The following sentence in your last letter jars on an ear tuned to the exact thought of St. Thomas Aquinas: "A wafer is said to be converted into the body and blood of Christ." You meant, of course, "The substance of the wafer is said to be transubstantiated into the substance of the body" (not the blood, please) "of Christ."

Next point. From the earliest of times theologians have taught that phrases such as "the right hand of God" should be understood in a metaphorical sense. No Catholic who asserted that "the Resurrection" or "the paternity of God and the virginity of Mary" were metaphors could remain in communion with the Church. It is for the Church, not for you, to lay down what is fact and what is metaphor.

We will, if you like, go into the whole question of the attitude of the Church to celibacy and sex in a later letter;

there are few subjects on which non-Catholics more often go wrong.

And now for St. Mark once more. You people who are too modest to feel sure that you really exist are very difficult to convince of error. Let me repeat that Christ in this passage prophesies certain miracles, and also tells his disciples that those who remain unconverted by their preaching will be condemned, but not necessarily to eternal punishment. It is not unreasonable to deduce from this that those who reject Christianity in the twentieth century are running much the same risk as those who rejected it in the first century; but it is grotesque to deduce that all Christians are immune from snake-bite because Christ prophesied a particular incident on the island of Malta when St. Paul threw off a viper into the fire.

With regard to your suggestion that I have joined the ranks of outsiders who tell scientists how to do their jobs, I have as much right to criticize scientists as you have to criticize theologians. More perhaps, since I have devoted more time to science than you have to theology, and I have yet to be convicted of travestying a scientific doctrine as you have travestied the doctrines of transubstantiation.

The whole question of the relations between the Church and science is surrounded by a dense fog of prejudice and ignorance. Free-thinkers have been extremely clever at exploiting the tactical advantages of that foolish phrase, "the conflict between religion and science." There is no such conflict. There is, however, a very real conflict between the scientists who do, and the scientists who do not, believe in the supernatural. May I quote a passage from my Introduction to the new edition of *The Flight from Reason*? "There lies before me as I write a book called *The Religion of Scientists*, edited by C. L. Drawbridge, M.A. (Ernest Benn, Ltd.). Mr. Drawbridge circularized all the Fellows of the Royal Society to elicit their views on religion. In answer to the question, 'Do you think that Science negatives the idea of a personal god as taught by Jesus Christ?' 26 Fellows of the Royal Society replied that science does negative this idea, 103 replied that natural science does not

negative this idea, 47 expressed a definite belief in the survival of personality, and 41 expressed definite disbelief. In reply to the question, 'Do you think that the recent remarkable developments in scientific thought are favourable to religious belief?' 27 replied in the negative and 99 replied in the affirmative. Making all allowance for those who did not reply to these questions, or who sent in replies too indefinite to be classified, I maintain that this symposium proves conclusively that only a small minority of scientists still persist in maintaining the quaint idea that science has disproved the existence of God or the immortality of the soul."

The myth that the Church has any quarrel with science owes its origin to the Galileo blunder—a blunder which has been magnificently advertised. The real interest of the Galileo case is the fact that it is a theological "sport"; an unfortunate exception to the Church's normal policy of encouraging science and honouring scientists.

The discovery that the world revolves round the sun was first published in a book which would never have seen the light of day but for the active interest of two cardinals, a book which was dedicated by its author, Canon Copernicus, to Pope Paul III.

Neither Paul III nor any of the nine Popes who followed him protested against the Copernican doctrine. In 1596, thirty years before Galileo got into trouble, the Protestant biological faculty at the University of Tübingen censured Kepler for writing a book in support of the Copernican doctrine. They made things so unpleasant for Kepler that he fled. And to whom? To the Jesuits of Gratz, who welcomed him warmly. Both Luther and Melanchthon inveighed against the blasphemy of a moving earth long before Rome itself was infected by this general alarm. Had Galileo been content to maintain the Copernican theory as a convenient hypothesis which explains phenomena in a simpler manner than the Ptolemaic, he would have been left in peace. He got into trouble because he invaded the sphere of the theologian and maintained that scripture had blundered.

The decree of the Holy Office which censured these views

was, of course, a great blunder. But it must be remembered that, on the evidence available at the time, the case for the Copernican system was by no means overwhelming. Huxley, who looked into the matter, came to the conclusion that on the available evidence "the Pope and the Cardinals had rather the best of it." Directly after the trial of Galileo, Cardinal Bellarmine, perhaps the most influential of the cardinals, sent a letter to Foscarini in which he said that, had Galileo been content to show that his system explained celestial phenomena without denying the truth of scripture, all would have been well. He added that if it could really be proved that the sun was fixed, a possibility which he clearly contemplated, it would be necessary to consider carefully the passages in scripture which seemed to prove the contrary, and that it would then be necessary to admit that these passages had been misunderstood, "to pronounce that to be false which is demonstrated."

So great was the respect of the Church for science that Galileo was treated with consideration far greater than that which would have probably been accorded to a priest who had sponsored his theories. "In the generation which saw the Thirty Years War," writes Professor Whitehead, "and remembered Alva in the Netherlands, the worst that happened to men of science was that Galileo suffered an honourable detention and a mild reproof before dying peacefully in his bed."

Galileo, you will see, was censured for much the same reason that the Waterston Paper, referred to in one of your recent letters, was refused publication, and for much the same reason which induced you to turn down two papers submitted to you, "not because they attacked current opinions," but because you thought the "evidence in them inadequate to make them plausible."

Scientific pioneers, as I show later in this letter, have had to fear not the Church but organized scientific opinion. A man's foes are those of his own household and his own trade union. The real conflict is the conflict between science and the scientists, not the conflict between science and religion.

In a recent letter you referred to the scientists who had

been burnt alive "at the instigation of the clergy," a loose phrase which conjures up a picture of scientists being roasted alive because the Church objected to their scientific discoveries. Joad made a similar remark, and you had the advantage of reading my reply to Joad. You wisely retreat from an impossible position as adroitly as possible. You tell me that you did not mean that these scientists were burnt as scientists, which is precisely what nine hundred and ninety-nine readers out of a thousand would have deduced from the remark to which I have referred. They were burnt as heretics, you tell me. Well, so were a great many priests, soldiers, butchers, and candlestick-makers, and their fate has therefore no bearing whatever on the general subject of the relations between the Church and science. Incidentally, would you please be good enough to name any scientists of European reputation who were burnt by the Catholic Church?

You reply in effect that science is atheistic in detail, from which I am perhaps expected to deduce that the execution of an atheist is an attack on science. I deny that science is atheistic in detail, though I agree that "the phenomena of disease and inheritance can largely be explained without invoking the hypothesis that God exists." "Largely" is the operative word in this sentence. I am glad to note that you concede by implication that these phenomena cannot be *entirely* explained without assuming the existence of God. The ultimate explanation of everything that exists is God; science, which is concerned with secondary causes, need not normally invoke God as a solution for the immediate problem.

As you have mentioned Pasteur, may I remind you of the famous saying of that eminent scientist to the effect that he believed everything that a Breton fisherman believed, and that if he were a better scientist he would probably believe everything that a Breton fisherman's wife believed.

You imply that jealousy and obscurantism are uncommon in the scientific world. Thomas Huxley was less sanguine. He describes "pedantry and jealousy as the besetting sins of scientific men," but perhaps things have improved since Huxley's day, and no doubt you will tell me that the

following letter of Huxley's is quite untrue so far as modern scientists are concerned: "You have no notion of the intrigues," wrote Huxley, "that go on in this blessed world of science. Science is, I fear, no purer than any other region of human activity; though it should be. Merit alone is very little good; it must be backed by tact and knowledge of the world to do very much.

"For instance, I know that the paper I have just sent in is very original and of some importance, and I am equally sure that if it is referred to the judgment of my 'particular friend' that it will not be published. He won't be able to say a word against it, but he will pooh-pooh it to a dead certainty.

"You will ask with some wonderment, Why? Because for the last twenty years —— has been regarded as the great authority on these matters, and has had no one to tread on his heels, until at last, I think, he has come to look upon the 'Natural world' as his special preserve, and 'no poachers allowed.' So I must manœuvre a little to get my poor memoir kept out of his hands."

Professor David Starr Jordan has summed up with great discernment the true nature of the alleged conflict between theologians and scientists. "The real essence of Conservatism," he writes, "lies not in theology. The whole conflict is a struggle in the mind of man. It exists in human psychology before it is wrought out in human history. It is the struggle of realities against tradition and suggestion. The progress of civilization would still have been just such a struggle had religion or theology or churches or worship never existed."

I must now substantiate by a few instances, chosen at random, my statement that scientific pioneers have had much to suffer from organized scientific opinion.

Galileo met with even greater opposition from contemporary scientists than from the misguided Pope whose attitude was such a contrast to that of his nine predecessors. He invented the telescope, and his first teacher at the University of Padua flatly refused to examine the planets or the moon through his telescope. Lord Bacon, whom foolish people credit with the invention of the experimental

method, bitterly opposed the Copernican system. Harvey lost half his consulting practice because physicians believed that his famous theory of the circulation of the blood could only proceed from a man who was unbalanced. Stenson, who discovered that the heart was a muscle, found the scientists of the Netherlands so unsympathetic that he moved on to Italy, where he was so much impressed by the keen interest displayed by ecclesiastics towards new ideas that he joined the Catholic Church and entered the priesthood. Jenner's views on vaccination met with bitter opposition. Auenbrugger, who discovered the method of the percussion of the chest, had to confess that "envy and blame and even hatred and calumny have never failed to come to men who have illuminated art or science by their discoveries." Dr. Thomas Young, who promulgated the theory of light waves and of the ether, encountered tremendous opposition.

As to Darwin. What precisely did Darwin do? As the pioneer of the evolutionary theory he was anticipated by Buffon, by Lamarck, and by Erasmus Darwin. The term "Darwinism" is often used as the equivalent for "evolution." Eminent scientists, such as Sir Arthur Keith, are guilty of this slovenly inaccuracy. Darwinism, properly speaking, means the theory that evolution can be explained by the sole agent of natural selection. This theory was first tentatively put forward in 1813 and later in 1831. Darwin cannot even be credited with being the first to propagate that famous superstition. Darwin achieved eminence because he had the amazingly good luck to ventilate other people's theories at a time when the world was ripe for the evolutionary theory. His book, *The Origin of Species*, is one of the worst-written books in the English language. Its obscurity is, perhaps, partly due to the fact that Darwin was more concerned to establish a claim to originality than to clarify his own ideas.

"Exposition," says Thomas Huxley, "was not Darwin's forte. His English is sometimes wonderful. But there is a marvellous dumb sagacity about him, and he gets to the truth by ways that are as dark as those of the heathen Chinee."

What remains of Darwin's greatness if Darwinism be rejected? Is it unfair to describe Darwin as a mediocrity if the conclusion which he reached was wrong, if he reached that conclusion "by ways as dark as those of the heathen Chinee," and if, in the opinion of his warmest admirer, he wrote bad English and had no gift for exposition?

Here is a passage from one of Darwin's works: "If an earthquake occurred in England, what would become of the lofty houses, thickly parked cities, great manufacturies [*sic*], the beautiful public and private edifices?" One need not be a genius to answer this question. If the earthquake was severe "the beautiful public and private edifices" would depreciate in value. "The greatest of living men," as Darwin was described by an enthusiastic contemporary, then proceeds to explain that if the earthquake continued for some considerable time "England would be at once bankrupt," and that "all papers, records and accounts would from that moment be lost." There is a great deal more in this strain, and it is difficult to believe that a man who, at the age of thirty-three, could cover paper with these dreadful commonplaces was a genius.

As a layman in scientific matters I have been both impressed and depressed by the flood of fulsome panegyric of which Darwin was the theme. "Newton and Darwin stand together," writes Professor Poulton, "in the select company of the greatest men the world has ever seen. He combined, it would seem, the intellect of a Newton with the moral genius of a St. Francis."

"Of Darwin's pure and exalted moral nature no Englishman of the present generation can trust himself to speak," writes Mr. Grant Allen.

Nothing is more surprising than the lack of effective opposition to Darwinism when Darwin's book first appeared. Mivart wrote a first-rate criticism, but Mivart was ignored because Mivart was a Catholic. Perhaps the most gifted and the most persistent critic of Darwinism was Samuel Butler, but nobody took Butler seriously—till he died.

Medicine provides many examples of heresy-hunting. The fact that Sir Herbert Barker has been knighted suggests that his work is not altogether valueless; yet Dr. Axham was

struck off the Medical Register for administering anaesthetics to Sir Herbert's patients. If people choose to consult the arch-heretic Barker, let them at least suffer as much physical pain as possible in the process. I leave you to supply the theological analogy.

If this letter were not already too long I should conclude with quoting a series of examples to illustrate the obscurantist attitude of scientists to new facts.

Again and again scientists have rejected the evidence for new facts, not because the evidence was unconvincing, but because the facts in question conflicted with their own narrow and *a priori* views as to how the universe should function. Planets were condemned by the scientific fashion of the day to move in perfect circular orbits, for an elliptical orbit was regarded with much the same horrified disgust as the phenomena of the séance room are regarded to-day. But the attitude of scientists to psychical research deserves, and will receive, a letter to itself.

Yours ever,
ARNOLD LUNN.

X.

SOME SCIENTIFIC TORQUEMADAS

Feb. 20, 1933.

DEAR LUNN,

I note that you have not taken up the challenge which I put to you in my last letter about married saints. I take it therefore that you admit the points which those questions were designed to elucidate—that is to say, that celibacy is nowadays a prerequisite if one is to become a saint.

You object to my statement "A wafer is said to be converted into the body and blood of Christ." And you tell me that I meant "the substance of the wafer is said to be transubstantiated into the substance of the body (not the blood, please) of Christ." You will excuse me, but I meant exactly what I said there and elsewhere. Your ear may, as you claim, be "attuned to the exact thought of St. Thomas Aquinas." But you do not appear to know what he wrote. In the *Summa Theologica*, Quaestio LXXV, Art. 8, you will find: "Respondeo dicendum quod haec conversio panis in corpus Christi quantum ad aliquid convenit cum creatione et cum transmutatione naturali, et quantum ad aliquid differert ab utraque"—"I answer that one should say that this conversion of the bread into the body of Christ agrees to some extent with creation and natural transmutation, and to some extent differs from both." Later he makes a detailed comparison with the conversion of air into fire, a chemical process. In the next chapter (Quaestio LXXVI, Art. 2) he writes: "Nam sub speciebus panis est quidem corpus Christi ex vi sacramenti, sanguis autem ex reali concomitantia . . ."—"For under the species of the bread the body of Christ is indeed [present] by the force of the sacrament, the blood on the other hand by real concomitance . . ." St. Thomas further held the peculiar opinion that the whole Christ (*totus Christus*) is present in each species (bread and wine) of the sacrament, and in every particle of it.

I can well understand your reluctance to believe in so

absurd a doctrine. It was shared by the Calixtine heretics in Bohemia, and cost a very large number of them their lives at the hands of the champions of the Church. But I could wish that you were acquainted with the views to which you desire to convert me, and would not accuse me of travestying the doctrine of transubstantiation when I attempt to describe the opinions of the Angelic Doctor. It was another Balliol man, a sixteenth-century Catholic convert called Bagshaw, whom the Jesuits dubbed "Doctor erraticus." Perhaps you are trying to emulate him.

I thought that you would quote my remarks on Hindu practice (which were not, by the way, all as unfavourable as those you cite) as a refutation of Hindu theory. And yet you might regard me as illogical if I stated that Torquemada's actions disproved Aquinas' philosophy. Fortunately a more direct refutation is possible. Nor can I agree with you that the Koran is dreary. I think that you will have to search the Bible rather thoroughly before you find a more memorable phrase about the last judgment than Muhammad's (or Gabriel's): "The day that shall turn little children grey-headed." The Koran, you must remember, is partially written in rhyme, and loses greatly by being rendered into prose by non-Islamic translators. When we next meet remind me to recite you the Surat-al-Fatiha. I doubt if even my execrable accent can completely ruin it. And I think that your possibly over-contemptuous attitude, which is widely shared in this country, may be responsible for a good deal of the present instability of the British Empire.

If you merely mean by saying that the universe is rational that it has structure and a certain uniformity, it is a pity to use the same word which is employed when we say that man is a rational animal. And why, oh, why, do you call Mr. Joad a scientist? You might as well call him a bishop! His published work, and particularly *The Meaning of Life*, shows a very thoroughgoing refusal to accept well-established scientific facts.

At last we have got your theory about that passage from St. Mark. It appears to you that the threats still hold good, but the promises are now obsolete. A convenient principle often acted upon by Christian governments! But

I still feel that the Hopi Indians of Arizona (or is it New Mexico?), who habitually use live and active rattlesnakes in their religious dances, have, in view of this passage, a better claim to be called Christians than is commonly supposed.

Now for Mr. Drawbridge: 129 out of 501[1] Fellows of the Royal Society answered him definitely as to the existence of God, and of these only 26 thought that it was disproved by science. But approximately three-quarters of the Fellows did not answer. Clearly all those who approved of the Christian Evidence Society did so. So doubtless did the more ardent atheists. But the large majority did not. The average irreligious scientist presumably pitched Mr. Drawbridge's questionnaire into the waste-paper basket, probably after a rude remark about the ambiguity of some of his questions. If you maintain that a census of one-quarter, not taken at random, of one society proves anything conclusively (your expression) about scientists as a whole, you merely demonstrate the laxity of your canons of evidence.

Your account of Copernicus and Galileo is quaint. The discovery that the earth revolves round the sun was first published, not as you state, by Canon Copernicus, but by Aristarchus, some centuries before there were any canons. To credit Copernicus with this discovery is like crediting Darwin with the theory of evolution. But the former, and not the latter, misstatement reflects credit on the Church, and is therefore so frequently made that you doubtless repeated it without thinking.

I note with interest the parallelism between Galileo's treatment and my own: also the differences. If I was arrested and threatened with torture I have doubtless forgotten these incidents. All that happened to me or Waterston was that certain people would not publish our papers at their expense. But Galileo's books were put on the *Index Expurgatorius* and their circulation forbidden, whereas Waterston and I could have published our papers at our own cost. Galileo, you say, "got into trouble because he invaded the sphere of the theologians and maintained that Scripture had blundered." Exactly. When the

[1] The number on December 31st, 1931.

Church had its way this is what happened. Theologians could invade anyone's sphere and make pronouncements on law, morals, politics, economics, and science. But if anyone invaded their sphere he was lucky if, like Galileo, he escaped with a mere threat of torture. When scientists begin to clamour for your arrest, or that of the Bishop of London, for talking what seems to them nonsense about science, you can begin to write about scientific intolerance.

I am quite aware, by the way, that the Protestants were often just as intolerant as the Catholics. In the eyes of a secularist there are two main things to be said in favour of Protestantism as against Catholicism. The Reformation weakened Christianity, and the Protestant Churches were never so powerful as the Catholic.

You ask me to name any scientists who were burnt by the Catholic Church. I take it that this was intended as a trap. When an ecclesiastical tribunal had found a man, woman, or child guilty of certain offences, the victim was handed over to the secular authority to be punished "without shedding of blood" (*sine effusione sanguinis*), and was then burned alive. On the basis of this subterfuge Catholic apologists have claimed that the Church does not persecute, and is not guilty of the death of these persons. On the other hand, most decent-minded people find it impossible to believe that an organization capable of such hypocrisy is the servant of a good God. If I had given you any names (e.g. Bruno) you might have caught me on this somewhat technical point.

I don't think that you quite took my point about the atheistic character of science. I said that the phenomena of inheritance could be *largely* explained without bringing in God simply because a good deal still remains unexplained, and not because I can see the faintest scintilla of evidence that God is concerned in the matter any more than in the working of an automobile. There is, I admit, some very inadequate evidence, which we will discuss later, that He is concerned in both.

Nor for your great attack on scientific intolerance. You state that "scientific pioneers have had much to suffer from

organized scientific opinion." You give the following examples. A teacher at Padua would not look through Galileo's telescope. Francis Bacon bitterly opposed the Copernican method. Harvey lost half his practice because the physicians of his day did not agree with him. I should hesitate to call English physicians of the twentieth century a body of scientists. They were certainly not so in the seventeenth century. Stenson found Dutch scientists unsympathetic. Jenner and Aunbrugger also met with medical opposition. Young met with "tremendous opposition." You do not state that his main opponent was a politician, Lord Brougham. And that is all, till we come down to modern times.

You have not produced a shadow of evidence that "organized scientific opinion" was arrayed against these men. Actually Harvey was elected Treasurer of the College of Physicians in 1618, the year of the publication of his work on the heart, and President in 1654. Jenner was a Fellow of the Royal Society. Only eight years after the publishing of his first book on vaccination the College of Physicians reported in favour of it. Young became a Fellow of the Royal Society at the age of twenty-one, and Foreign Secretary of it at the age of twenty-nine. Such were some of the sufferings which your English examples underwent at the hands of organized English science. Of course they had to submit to a certain amount of criticism, and a good thing too. It doubtless induced them to clarify their expositions and confirm their observations. But if that sort of treatment is organized opposition, I only wish some organization would start opposing me.

Mivart, you say, was ignored because he was a Catholic. In the sixth edition of *The Origin of Species* Darwin refers to him five times. The main discussion of his objections occupies twenty-seven pages (164–191) from which I proceed to quote: "A distinguished zoologist, Mr. St. George Mivart, has recently collected all the objections which have ever been advanced by myself or others against the theory of natural selection, as propounded by Mr. Wallace and myself, and has illustrated them with admirable art and force. . . . All Mr. Mivart's objections will be, or have

been considered in the present volume. . . . Nevertheless I will consider in some detail several of the cases advanced by Mr. Mivart, selecting those which are most illustrative, as want of space prevents my considering them all." Do you think that Darwin ought to have devoted an entire book to answering Mivart, because he was a Catholic? Or that Huxley was boycotting him when he mentioned his name only fifty-nine times in one essay in *Darwiniana*? Perhaps you will tell me in your next letter how many thousand words must be devoted to answering a person before you can escape the charge of ignoring him.

You write: "I have yet to be convicted of travestying a scientific doctrine as you have travestied the doctrine of transubstantiation." I must leave our readers to decide the accuracy of your accusation of me. You will now be convicted. You make the ridiculous assertion that "Darwinism, properly speaking, means the theory that evolution can be explained by the sole agency of Natural Selection." I can only assume that you have not read *The Origin of Species*. Its first two chapters deal with variation as an essential condition for evolution. Here are some quotations from it (references to the sixth edition):

"He[1] likewise assumes that I attribute nothing to variation, independently of natural selection, whereas in the work just referred to I have collected a greater number of well-established cases than can be found in any other work known to me" (p. 104). ". . . But many animals possess structures which can best be explained by the effects of disuse" (p. 100). ". . . These several considerations made me believe that the wingless condition of so many Madeira beetles is mainly due to the action of natural selection, *probably combined with disuse*" (my italics; p. 101). "On the whole we may conclude that habit, or use and disuse, have, in some cases, played a considerable part in the modification of the constitution and structure, but that the effects have often been combined with, and sometimes overmastered by, the natural selection of innate variations" (p. 106).

Do you want any more, or will you admit that Darwinism as defined by you is not the theory propounded by Darwin?

[1] Your Mr. Mivart.

You ask me, "What remains of Darwin's greatness if Darwinism be rejected?"

I will give a short account of some of Darwin's main work apart from that bearing on evolution. He made a still unsurpassed survey of the variation of animals and plants under domestication. This book was published in 1868, and is still indispensable to geneticists. His studies on coral reefs and on the action of earthworms did much to make geology a living science. His work on self-fertilization and cross-fertilization, and on heterostylism, founded a whole branch of genetics. Unfortunately in this work he gave way to his one serious failing, namely, modesty. He found that the characters short style and long style in *Primula* obeyed what are now known as Mendel's laws. But while his own observations all agreed with the view that the short-styled condition is dominant (which we now know to be the case) he combined the records of one Hildebrand with his own. When an accurate technique is used, Darwin's results are confirmed, Hildebrand's are not. As he took Hildebrand seriously, he did not enunciate the very simple law which followed from his own observations. In order to become acquainted with the principles of zoological classification, he made a special study of barnacles, discovering, among other things, the microscopic males of many species. He did fundamental work on movement in plants, especially climbing and insectivorous species. No other scientist has done fundamental work in zoology, botany, geology, and genetics.

I have so far said nothing about his work on evolution. In my opinion his theory of heredity was false, and he attached far too much importance to the inheritance of habit, in which Butler believed. But I believe that his main thesis regarding the effects of natural selection was substantially right. If you disagree you are at liberty to tell me why. But it would perhaps be advisable for you to find out what Darwin wrote before you refute him.

You do not like his style. No wonder. He actually contrived to do two very difficult things. He did not say more than he meant, which involves the use of words like "probably" and "sometimes," and does not make for catchy phrases. And he attempted to consider all the objections

to his theories, which makes for long-windedness. I can quite see why you prefer Samuel Butler, whose writings suffer from neither of these defects.

You bring up the case of Sir Herbert Barker. What has this to do with science? Medical men form a closed corporation. So do lawyers, parsons, locomotive engineers, chartered accountants, and stockbrokers. Scientists do not. Or if they do, please tell me about it. I agree that the medical profession copies the mediaeval gilds rather too closely. I take it that their attitude is that if they admitted Barker they would have no logical or legal ground for keeping out other less desirable unqualified men. But what has this to do with science? Doctors apply science. So do motor-mechanics and seedsmen. If they also copied their exclusiveness from scientists I should have a case to answer. And I should answer it. Actually the medical profession is delighted to obtain help from outsiders if they do not act in such a way as to throw its members out of work as healers. For example, I have often lectured to medical audiences, and sometimes been well paid for it. But if I started taking money from patients they would object, and in my opinion rightly.

May I sum up your criticisms of my profession. We do not at once accept certain theories. This is "persecution" or "boycotting." We accept others. This is "the latest scientific fashion." Some professions which apply science adopt trade union principles. We expect our critics to take cognizance of facts. These facts are called "our own narrow and *a priori* views."

Yours very truly,
J. B. S. HALDANE.

XI.

CORRECTION ON POINT OF FACT

SUTTONCROFT,
BICKLEY.
March 27, 1933.

DEAR HALDANE,

I have delayed answering your letter until my return home, for my Mürren library does not include the works of St. Thomas Aquinas.

I am sorry that I gave you the impression that I regard Joad as a scientist. The sentence in which I referred to him might perhaps have been more clearly expressed, but it was certainly not intended to convey that implication. Joad, I am sure, would be as anxious to disown, as I should be reluctant to make, any such insinuation.

Again, you make a general accusation against the clergy of burning scientists alive. I ask for names. You produce Bruno. Now, Bruno had even less claims than Mr. Joad to be considered a scientist, and vastly less than Lord Bacon, for Bacon did at least devote considerable time to the formulation of a method which he believed, falsely as we agree, would facilitate scientific discovery. You deny that doctors are scientists. But surely the study of health belongs to science. Or are we to understand that it is scientific to study the skeletons of Neanderthal man and unscientific to study the living bodies of our contemporaries?

I think I see your point. A man becomes a scientist when, like Bruno, he is burnt by the Church, and ceases to be a scientist when he belongs to a corporation which, like the B.M.A., indulges in heresy-hunting.

You sweep aside as unimportant the cases which I have quoted of men who have suffered from the jealousy of their scientific colleagues; and very wisely you ignore my quotation from Thomas Huxley. Huxley, as you will reluctantly remember, describes jealousy and pedantry as "the two besetting sins of scientific men." You can only acquit scientific men of this charge by convicting Thomas Huxley of "making damaging assertions" against your profession.

On the other hand, your case against the Church, so far as persecuting science is concerned, appears to boil do to the historic blunder of the Galileo trial. But blunder does not justify such sweeping accusations. you any evidence for suggesting that Galileo was thre with torture? Please answer this question, and please to my challenge to name six scientists of European re tion who were burnt alive by the Church. I select number "six" as a retort courteous to your challenge about celibate saints.

Your attempt to evade my challenge to name scientific martyrs is amusing. You imply that you can produce a long list of names, but refrain from doing so because you believe me capable of taking refuge in a pitiful subterfuge; of defending the Church, that is, on the ground that the victims of the Inquisition were handed over to the secular power to execute. I do not know a single modern Catholic writer of any standing capable of putting forward so fatuous a defence. This is the only statement of yours which has nettled me. I cannot believe that you think so badly of my controversial ability; if you did you would surely not cross swords with me. I object, my dear Haldane, to your making damaging assertions against me unless you can substantiate them.

Moreover, this particular assertion is not only unsubstantiated, but has been refuted in advance. You had only to turn up *Inquisition* in the Index to my joint work with Joad to save yourself from the controversial blunder of putting into my mouth a defence which I am incapable of employing.

While we are on the subject of the Inquisition, let me say that Torquemada represents a real difficulty for the Catholic apologist, but your parallel between Torquemada and the beastliness of Hinduism in practice is inexact. Torquemada does not refute Catholic philosophy for two reasons In the first place, the Inquisition represents, as all Catholic concede, a perversion of Christianity, whereas the mo loathsome features of Hinduism are still maintained wi devotion as an integral part of that debased religion. the second place, Catholicism in practice has such a va

accumulation of merit on the credit side that even Torquemada does not tip the scale. Hinduism, on the other hand, uniformly beastly. Five hundred years hence, if the rs of Hinduism are as obsolete as the Inquisition, if girls of five are no longer reserved as prostitutes for pleasure of the temple priests, it may be possible to sider the claims of Hindu philosophy with detachment. eanwhile it is as foolish to compare Catholicism with Hinduism as to compare the altar-piece of a Bellini with the phallic designs, representing all stages of vice, natural and unnatural, which still adorn the temples of Hinduism. By the way, have you read *Hindoo Holiday* by J. Ackerley, a brilliant and entertaining picture of the most fatuous and most degraded of all conceivable religions?

And now having dealt with the minor points in your letter, allow me to make one general observation about your letter as a whole. I contend that scientists, like other people, have no uniform measure by which to judge men, or beliefs. I shall show in later letters that scientists welcome evidence which confirms, and view with hostility evidence which conflicts with, their own *a priori* views of the universe. The evidence for evolution, for instance, is far weaker than the evidence for telepathy or for ectoplasm; but almost all scientists accept evolution, and, until recently, most scientists rejected telepathy. Again, you regard it as legitimate to ridicule the heroes of the Church but scandalous to criticize the saints of science. You think it amusing to poke fun at the fatness of St. Thomas, but you begin to bristle the moment I question the moral splendour of Darwin.

The cases which I quoted in my last letter to convince you that heresy-hunting is not a monopoly of Churchmen were not, of course, intended to be a complete summary of all such cases, but merely a few outstanding examples. Incidentally, Dr. Young's chief opponent was not, as you ay, a politician. Dr. Gould, one of his biographers, tells s that Young was inclined to publish his great work on the eory of light waves anonymously "to avoid persecution d deprivation of practice." Many years passed before the rench Academy would permit the publication of Fresnel's apers on the subject of Young's theories; a quarter of a

century elapsed before those who had endeavoured to silence Young were themselves silenced. "But Young had been silenced too. His disgust was so great that he resigned from the Royal Society and devoted himself to his poor medical practice and to deciphering Egyptian hieroglyphics."

Please do not misunderstand me. I am not attempting to prove that scientists are more intolerant than other people. All I suggest is that if we are more interested in facts than in propaganda, and if we approach the problems of social psychology in a scientific spirit rather than in the spirit of the militant secularist, we shall realize that heresy-hunting is one of the most universal of all human traits. It might have been possible in the Victorian age to believe that the world was growing steadily more tolerant, but to-day, when over by far the larger part of the European area political heresies are more ruthlessly and more successfully suppressed than religious heresy was ever suppressed in mediaeval Europe, even the most prejudiced secularist of your school must find it difficult to believe that the Europe which is beginning to worship science is more tolerant than the Europe which worshipped God.

The fact that nobody has as yet been executed in the name of science is due to the historic accident that science, as you pointed out in your letter, is not yet organized for persecution. Consequently scientists have only been able to use such weapons as were in their power to make things uncomfortable for the heretic.

I have pointed out that the B.M.A. does its best to make things uncomfortable for medical heretics. I am not attacking their attitude to quacks, which is no doubt justified. "You do not seem to realize," a doctor once remarked to me, "that the B.M.A. are only concerned to protect people like you and me from malpractice." A good defence; no worse if no better than the arguments which have been advanced to justify religious persecution. For surely if the B.M.A. are justified, as they certainly are, in protecting the layman's bodily health from malpractice, the Catholic Church is equally justified in protecting the layman's spiritual health from spiritual quacks.

Science, like the Church, invokes the secular arm of the State to impose justice. A few years ago the French Government during a smallpox scare refused to allow foreigners to land in France unless they could produce a certificate to the effect that they had recently been vaccinated. If Catholic Ireland refused to allow Englishmen to land unless a priest was prepared to certify that they had confessed and been absolved, and were not in a state of mortal sin, there would be a fine hullabaloo about persecution from those who, like yourself, can see nothing odd about the exclusion of the unvaccinated from France. And yet it is as logical for a Catholic country to exclude those who might infect the spiritual as for France to exclude those who might infect the bodily welfare of her citizens.

There are many people who would agree with Mr. Bernard Shaw in his dread of organized science; many people who feel, as Mr. Bernard Shaw feels, that it would be more comfortable to live under the mediaeval rule of the Church than under the rule of organized science. If the sterilizers, eugenists, and other pseudo-scientific cranks have their way there would be far less freedom in the State of the future than in mediaeval Europe.

I seem to remember, but cannot trace the passage, some mordant criticisms from your pen on the political results in America of certain pseudo-scientific theories, e.g. the alleged superiority of the Nordic race. In another passage you profess yourself "extremely suspicious" of most of the attempts to "apply scientific principles to man in non-medical fields. . . . Much of what passes for scientific psychology seems to me profoundly unscientific. The same is true of eugenics, criminology, and many other ologies." For once we seem to be in agreement.

To sum up. I contend that any body of men, organized for the furtherance of a common object, will, if they are sufficiently powerful, use their power to suppress opinions which they regard as dangerous or pernicious. In this respect I do not think that there is anything to choose between mediaeval Churchmen and modern Fascists, Communists or scientists, once they get into power.

I did not answer your challenge about married saints

because I was writing away from books, and hoped that you would spare me the trouble of proving you wrong.

In your book you claim that Catholics regard celibacy as "a prerequisite of sanctity." Realizing that this statement as it stands cannot be defended, for one need not be a hagiographer to know that most of the apostles were married, you ingeniously attempt to retreat by naming an arbitrary date (1600), and by asking me to name half a dozen saints living later than 1600 who have been canonized. What an unscientific challenge! It is the century in which the saint is canonized, not the century in which he lived, which is relevant as evidence of the attitude of the Church. Had the modern Church regarded celibacy as "a prerequisite of sanctity" it would clearly not have canonized a man whether he was born before or since 1600.

I need not, of course, tell you that the Church officially recognizes outstanding sanctity either by beatification or by canonization. In many cases beatification is the prelude to canonization. At the present moment, for instance, Catholics are praying for the canonization of the Blessed Thomas More, who was beatified in 1886. The Blessed Thomas More was *twice* married. Here, are a few more examples of married men and women whose unusual sanctity has been officially recognized by the Church:

St. Ferdinand III, King of Castile, was canonized in 1471; St. Catharine of Genoa was canonized in the eighteenth century; St. Isidore and his wife were both canonized, the former in 1622; St. Francis Borgia, St. Alphonsus Rodriguez, and St. Frances de Chantal were all married, though they entered the religious state after the deaths of their wives; the Blessed Margaret Clitheroe was beatified. Anna Maria Taigi, who was born in 1769, remained with her husband and had charge of his household until her death in 1837. The husband survived her and gave evidence at the age of ninety at the process of beatification. She was beatified in 1920. The Blessed Paolo de Gambara Costa, who was beatified in 1845, spent most of her life with an unfaithful husband. The Blessed Humbert of Savoy was married at least three times; he was beatified in 1838. The

Blessed Villana di Botti, also a married man, was beatified in 1824.

Your quotation from the decrees of the Council of Trent only proves what nobody denies, that the Church maintains virginity as a higher state, that is, a state more free for occupation with God: Mary as against Martha. Only those who have a clear vocation should take vows of celibacy, and, for the rest, the Church teaches that it is perfectly possible for a married man or a married woman to live a life of most outstanding holiness while remaining in the world.

And that will do. A hagiographer could doubtless provide you with many more examples. I have only quoted sufficient to prove that the statement which I originally criticized was inaccurate and unhistorical. I await your withdrawal.

I have left to the last your comic attempt to refute the Catholic doctrine of transubstantiation with the aid of St. Thomas Aquinas, for I fear that had this letter begun with the abstruse theological discussion which you provoke the average reader might have given it up in disgust. The average reader is hereby warned that what follows will be stiff reading, which he can leave unread if he is prepared to accept my statement that you have made a sad mess of St. Thomas.

St. Thomas was one of the greatest philosophers of all time. Every century produces its shoddy crop of substitutes for the Catholic faith. How they date! Those predecessors of the Wellses and Bertrand Russells of our day. Thousands of years after the leaders of modern thought have been forgotten St. Thomas, I venture to prophesy, will still be regarded as one of the master minds of all time.

Now your mistake is to assume that you can dip into St. Thomas with your feet on the fender. He deserves, and receives from the discerning reader, patient and careful study. If you thought of him as a mountain towering above your head rather than as a valley above which you, as a child of the twentieth century have climbed, you would be far more likely to grasp what he is driving at.

Like most scientists you fail to realize that theology is a science which, like other sciences, has its own vocabulary. In the last century a certain Dr. Littledale attempted to attack the morality of certain of St. Liguori's teachings. The poor man did not realize that casuistry, like other branches of law, has its own technical vocabulary and, as a result, he made a very complete fool of himself. You go wrong for a similar reason. You have not taken the trouble either to master St. Thomas's philosophy or his terminology; you have not begun to understand what he means by "concomitance." Again, your first reference to St. Thomas in an earlier letter showed that you were guilty of that vulgar error which the Thomist has learned to greet with a weary yawn. St. Thomas, you tell us, "tries to prove the existence of a creator from the impossibility of an infinite regress." He does no such thing, as you will learn when it is my turn to defend my beliefs—and his. I have always contended that the modern secularists are completely reckless in their attacks on the Church, and I am glad that you dragged in St. Thomas to corroborate this theory. For you have advantages which most secularists do not possess. You have dipped into Catholic literature; you have heard of St. Thomas; you can quote Catholic writers. If, therefore, I can show, as I can, that you have made the most elementary blunders about Catholic doctrines, and that you have hopelessly misunderstood St. Thomas Aquinas, it follows, *a fortiori*, that the reader will be well advised to disregard as uninstructed and amateurish the sort of stuff which is inflicted on the public by other members of your school far less able than you, and even less instructed in Catholic matters than yourself.

Your attempt to defend yourself by quoting from St. Thomas and mocking at my ignorance has, unfortunately for you, betrayed you completely into my hands. You profess superior knowledge. It would have been far better, I assure you, to have climbed down and admitted your mistakes. Frankly, your defence is shamefully bad. I corrected you on an acknowledged point of theology—to the effect that "the substance of bread is transubstantiated into the body of Christ," not the body and blood as you

said. Instead of yielding, as anyone who knows the rudiments of the question would do, you produce triumphantly a passage which says, "Under the species of the bread the body of Christ is indeed present by the force of the Sacrament, the blood on the other hand by real concomitance." Precisely: the bread is transubstantiated into the body of Christ, not the blood; but as the body of Christ is a live body, the body which becomes present has in fact blood and soul and divinity. My correction was to enforce this distinction. You, evidently not knowing the meaning of the correction, quote my distinction to prove me wrong. Turn up the *Summa Contra Gentiles*, Book 4, LXIV, if you wish to discover exactly what St. Thomas meant by "natural concomitance."

That is one blunder of yours, and it prepared me for the second, for you evidently do not fear to rush at a passage of technical theology and tell me what it means without taking any trouble to understand it. You claim that Article 8 in LXXV proves your point, and will not believe me when I try to teach you that it doesn't. I say, therefore, that no single Thomist theologian would dream of giving your interpretation. All are with me. And as you won't believe my word I have shown your argument to Father M. D'Arcy, and asked his opinion. Father D'Arcy has written what is, perhaps, the best modern study of St. Thomas. His other writings as a Catholic philosopher have won him the commendation of theologians far from sympathetic to Catholics, such as Dean Inge.

In reply, Father D'Arcy writes as follows: "Of course there is no question that Haldane has misunderstood the article and, I suppose, the whole meaning of transubstantiation. It really is rather lamentable that he should write with such assurance and take such a high tone when he does not show the grasp of the subject even an amateur might be expected to have. His assurance casts a very ugly light on the subjects about which he writes with the same assurance. Anyone who knew anything about the history of the discussion round the Eucharist would have been able to avoid his mistakes. The discussion had been going on vigorously since Pascharius in the 9th century, and all sorts

of views had been put forward. Any acquaintance with the nature of those views would have provided a background against which those which Haldane tried to foist on to St. Thomas would have looked ridiculous. But the very passage which he quotes gives the lie to his interpretation, and how he can have avoided seeing this beats me. Haldane says that because St. Thomas says that to some degree transubstantiation is like natural transmutation, and because he uses the comparison of air with fire, therefore transubstantiation is a chemical process and his interpretation is right. But what does St. Thomas say in this passage? He is trying to explain the nature of transubstantiation. It means that the whole and complete substance of bread is converted into the whole and complete already existing body of Christ without changing it. (Haldane does not seem to have realized that this is what it means, and that the body of Christ is already complete—not something new issuing from the bread—and that it remains unchanged save as to the mode of its presence. This is enough in itself to settle the question of chemical change of wafer into body.) He says it is unique, but can be compared both to creation and ordinary natural changes to this extent—that in all three there is an order of succession, (1) from non-being to being, (2) from bread to body, (3) from air to fire. Furthermore it is like (1) creation because there is no common subject for the two terms (non-being—being; bread —Body). That also settles the question of chemical change. But transubstantiation is unlike creation and like to (3) natural change in that it is not nothing but bread which is converted into the body of Christ and so secondly in transubstantiation the accidents of the bread remain common, i.e. the accidents of the bread show now the presence of the body of Christ. He is very careful, however, even when saying this, to emphasize the essential difference between this conversion and the change of, e.g., air into fire. How anyone at the end of this can calmly say that transubstantiation is likened to the change of air into fire, and that as this is a chemical change, therefore transubstantiation is also, completely baffles me, as I said. All that St. Thomas is saying, as I hope my short analysis

proves, is to deny this. As the passage is very clear, and as I must acquit Haldane of intentional faking, he must have trusted to some obscure instinct which has led him wrong."

Whether transubstantiation takes place is, as I have said, a question of opinion: whether the Catholic Church teaches that transubstantiation is a chemical process is a question of fact.

You will not, I hope (the word "hope" is carefully chosen, for though hopeful I am not certain), pit your interpretation of St. Thomas against Father D'Arcy's or your view as to what Catholics believe about transubstantiation against the consensus of Catholic theologians. And if my hope is justified you will now admit that you have travestied a central doctrine of the Church.

Yours hopefully,
ARNOLD LUNN.

XII.

THOMAS AQUINAS & THOMAS YOUNG

16 Park Village East.
April 10, 1933.

Dear Lunn,

Your defence of the theory that scientific pioneers have been persecuted by "organized science" reminds me of the taste of the snark, which, as the Bellman pointed out,

> Is meagre and hollow, but crisp,
> Like a coat that is slightly too tight in the waist
> With a flavour of will-o'-the-wisp.

Your alleged atrocities in the past having been somewhat deflated you say, "Ah, but wait till science is organized and powerful, and you will see what dreadful things scientists will do," or words to that effect. Like your prediction that St. Thomas will enjoy a great reputation thousands of years hence, it has the immense merit that, even if it can't be proved, it can't be disproved in your lifetime. But the flavour of will-o'-the-wisp is undeniable.

You support your dreadful prophecy by the authority of Mr. Shaw, and the examples of the British Medical Association and the French Government. You tell me that I deny that doctors are scientists, and then proceed to prove to me that some are so. But not all, or even the majority, are. For one thing they are much too busy. I also admit that some doctors have displayed excessive professional jealousy. But to argue from these premises to the conclusion that some scientists have displayed excessive professional jealousy is to fall into the fallacy of the undistributed middle. Before your remarks about the medical profession have the faintest relevance you must show that it is dominated by scientific men. Nor is the French Government (to the best of my knowledge) a body of organized scientists. It may for all I know have acted unjustly in the name of science. But a sane person would not contend that no unjust action has ever been done in the name of science. By the way, let

me disagree profoundly with your description of eugenists as pseudo-scientific cranks. Some are. Some aren't.

I can quite understand your position. A Bill to prohibit blasphemous teaching to children (i.e. teaching of a character offensive to Christians as such) has just passed its second reading, and you would like to be able to quote similar persecutions (or shall we say similarly excessive zeal) by organized scientists. You haven't done so. You need not assume, as you do, that all men are as intolerant as Catholics and Fascists. Liberals of the despised nineteenth century actually believed in freedom of speech for their opponents. Scientists, if they got the power to do so, would be less likely than Catholics to persecute, because they know that their opinions are not final, while Catholics hold the contrary view on many points.

I like your wriggle about celibacy. The point which I tried to make is that the conditions for sanctity (by which I mean being a saint) have changed. In the primitive Church a bishop was supposed to be the husband of one wife. Now he must be celibate if a Roman Catholic. The qualification for sanctity has also changed in practice though not in theory. Your failure to produce even one married saint born since 1600 shows that a married man born in the last three centuries has about as much chance of becoming a saint as a Catholic bishop. There is no legal impediment to prevent a West Indian negro becoming a captain in the Coldstream Guards. But it hasn't happened and isn't likely to. In fact, I think it would be fair to say that "white" colour is a prerequisite to that position, even though I do not think this is mentioned in the King's Regulations. Your list of married saints of earlier birth, and of recent married promotions to what might be called the non-commissioned ranks of the Church triumphant, does not therefore impress me. (For the benefit of our irreligious readers I point out that beatification does not make one a saint.)

All that your Thomistic excursus has done is to suggest to me that either St. Thomas or his interpreters contradict themselves. Father D'Arcy states that "the whole and complete substance of bread is converted into the whole and

complete already existing Body of Christ without changing it." You state that "the body which becomes present has in fact blood and soul and divinity." As a body is not whole and complete without blood I fail to see that you were right in correcting me when I said that the bread was alleged to be changed into blood as well as body.

I agree with you that the Church does not teach that transubstantiation is a chemical event. But then I never said it did. Chemistry as a science did not exist in St. Thomas's time. Even the word has been invented since. When St. Thomas dipped into chemistry he was often wrong. Hence I suggest that it is perfectly legitimate for a chemist like myself to say whether, in my opinion, a given alleged process is or is not chemical, provided that I have read the official Catholic account of the process. Perhaps, however, I am wrong, and Father D'Arcy, by virtue of his office, can decide the rather vexed question of the frontiers of chemistry. I notice that neither you nor he have yet defined "chemistry" or "chemical." You have merely told me that I am wrong, which is much easier. Until you give me reasons to the contrary I shall continue in the belief that chemistry is concerned, among other things, with the transformation of one sort of matter into another sort.

I fear that we are not likely to agree on these two points, and further argument may be futile. I take it, however, that you no longer object to my statement that the wafer is said to be converted into the body. It is nice to find some point of agreement.

My evidence that Galileo was threatened with torture is, from the nature of the case, weak. Neither you nor I have had access to all the original documents. Among the authors who make the statement is Fahie, who states that he was threatened with "rigorous examination," a euphemism for torture. I do not know his source, though in view of the behaviour of the Inquisition in other trials it does not seem improbable. But I do not press the point, and if you produce strong evidence to the contrary, I will withdraw it.

Fortunately it is easier to test the truth about Thomas Young. You assert that he resigned from the Royal Society. On the other hand, the present assistant secretary

of that body tells me that Young was a secretary of it from 1804 up to the day of his death. Will you come with me to the Royal Society and let us examine the archives together to see whether this is correct? I may add that he discovered the law of interference of light in May 1801, and the criticism of him reached its height soon after. "His poor medical practice," by the way, was supplemented by £400 per year which he earned as superintendent of the *Nautical Almanac*, and secretary of the Board of Longitude; and he was not so completely silenced as to prevent him publishing work on polarized light, gravitation, coal gas explosions, life insurance, magnetism, and tides, as well as on hieroglyphics. In conclusion, let me quote from a letter written by this broken man, the victim of scientific intolerance, at the age of fifty-four:

"I find that there has been a pretty general conversation about making me President of the Royal Society, and I really think if I were foolish enough to wish for the office, I am at this moment popular enough to obtain it; but you well know that nothing is further from my wishes."

Unless you can convince me that this letter is a forgery you must excuse me if I do not take scientific intolerance quite as seriously as yourself, and retain a certain scepticism of your examples of it where I cannot check them.

Now as to the burning question. Permit me to state my opinion that Bruno had a considerably better claim than Butler to be called a scientist. The fact that he was elected professor of astronomy at Toulouse proves little, I admit. But he carried on the work of Copernicus by showing that astronomy could do without the "eighth sphere" of the fixed stars, which Copernicus had retained from the Ptolemaic astronomy. He supported the view, now well established by spectroscopy, that the stars are made of mixed materials like the earth. Kepler, whom you will hardly accuse of anti-Christian prejudice, expressed his admiration of Bruno's work. His biological views were of considerable interest. In *De Immenso* he stressed the importance of the extinction of animals in determining their present geographical distribution, with special reference to the fauna of England. So far as I know this was an

important and original contribution to the study of animal geography, which culminated in the work of Darwin, Wallace, and Willis.

Your refusal to admit him as a scientist puts me in a quandary. He was going to have headed my list of scientific martyrs. And at the present moment I only have three who were actually burned. You see I don't keep an anti-Christian card index. I could not name half a dozen Protestants burned under Mary, or atheists and Unitarians burned under Elizabeth. So it is not worth my while to hunt up more names if you don't admit my first.

I cannot deal with all your other statements, some of which I think fall by their own weight. But I will take up three minor points. Huxley said that the besetting sins of scientists were jealousy and pedantry. ("Pedantry," by the way, is the term which we apply, in controversy, to the accuracy of our opponents.) Now these are the besetting sins of all academic men and women. A life of research hardly attracts the votaries of avarice, sloth, murder, or lechery. Instead of wading through slaughter to a throne we catch out our colleagues on errors of technique. If we cannot command the applause of listening senates while denouncing the government we may keep a scientific society from sleep by attacking the theories of the older generation. I think, however, that as regards jealousy and pedantry, scientists compare very well with such other academic professions as philologists, theologians, and philosophers.

You will remember that the Baker in *The Hunting of the Snark*[1] expressed the belief that, if he meet a Boojum,

> I shall softly and suddenly vanish away
> And the notion I cannot endure.

I sometimes feel that your views on personal survival may have been influenced by this passage.

St. Paul, if I understand him, said that he could not endure the notion of death except when accompanied by

[1] My repeated quotation from this immortal work calls for some excuse. I am irresistibly led to it by your apparent belief in the Bellman's Theorem "What I tell you three times must be true." If we admit the truth of this statement it follows that Darwinism is a discredited dogma and Thomism the crown of philosophy. If we do not, I suggest that some alternative proof of these assertions is desirable.

the promise of resurrection. Clearly, the more firmly you believe in resurrection the less courage you need to face the prospect of death. I have no intention of insulting St. Paul, who was a stout man, and (in spite of what he wrote) would very probably have faced death with equanimity even had he thought that it would be the end of him. But surely you will admit that much of the success of Christianity has been due to the fact that it promises a happy life after death to its believers, and that the more they fear annihilation the greater is the efficacy of this promise.

Hinduism, you say, is altogether beastly. You cite the reservation of young girls for the pleasures of the priests. It is, I think, less than a century since the Vicar of Christ ceased to have young boys gelded for the pleasures of priests who admired the singing of *castrati*. His successor now fulminates against the idea that they should be submitted to a far less serious operation to prevent them from producing defective offspring. The "uniform beastliness" of Hinduism includes the practices of prayer, penance, and asceticism, the belief in heaven and hell, in the incarnation of the Creator in human form, in miracles, and in the infallibility of scripture. I am interested to learn that all these practices are beastly. Perhaps you will develop the point in your next letter.

Yours very truly,
J. B. S. HALDANE.

XIII.

DARWINISM

SUTTONCROFT,
BICKLEY.
April 22, 1933.

DEAR HALDANE,

Transubstantiation either takes place or it does not. If it does not take place, *cadit quaestio*. If it does, it is for the Church, to whom we owe our knowledge of the process, to define the nature of that process. Chemists are not unknown in the ranks of theologians, but there is no theologian, and indeed no Catholic chemist, who would not agree with Father D'Arcy that you have talked sad nonsense on this point. If you doubt me, ask Professor Whitehead, the only non-Catholic scientist who really understands, and who—because he understands—admires Catholic theology, whether you or Father D'Arcy are right. Your complete failure to grasp the point is once again demonstrated by your pious hope that I shall agree that the "wafer is said to be converted into the body." I am, however, consoled by the reflection that your chances of ultimate salvation will be improved by your remarks on this subject—remarks which prove that, so far as Catholic theology is concerned, your ignorance is literally invincible.

The evidence that Galileo was threatened with torture is, as you say, weak. The available evidence on the subject of gelding contradicts the statement which you have made. You inform me that "it is less than a century since the Vicar of Christ ceased to have young boys gelded," a monstrous perversion of the true facts. It was, I imagine, the parents of the boys or, perhaps in some few cases, the boys themselves who took this step in the interests of their professional careers. I agree with you that it was unfortunate that such boys should have been admitted to church choirs. Benedict XIV condemned this practice in good round terms. Clement XIV, on discovering that some such boys had again found their way into the principal choirs, threatened the authors of this operation with excommunication. If you want to pursue the subject further we will,

but it seems to be a rather foolish side-issue, and perhaps even you, much as you hate conceding a point, will accept the statement of Noldein, one of the chief authorities on moral theology, who writes: "The popes never approved of the gelding of boys nor said it was permissible. On the contrary, they declared that those who culpably made themselves and others eunuchs were 'irregular' " (a technical term which I will not stop to explain).

On the question of sanctity it is you, not I, who have "wriggled." Your statement that the Church had for long regarded celibacy as a prerequisite of sanctity would no doubt strengthen the average reader in that ignorant belief, common among the uninstructed, that the Church disapproves of sex as such. I have proved you wrong by quoting many examples of married people whose outstanding sanctity has been officially recognized by the Church. You attempt to evade the facts by a false distinction between the processes of beatification and canonization. These processes do not correspond, as you suggest, to different degrees of sanctity. Proof of outstanding sanctity is as necessary for beatification as for canonization. The question of sanctity is settled once and for all by the process of beatification, but clear evidence of miracles is required before the process of canonization can succeed.

Is it fair to set traps for one's opponent? It may not be fair but it is certainly fun. My prophecies as to the attitude of science in the future were designed to elicit from you a protest against drawing a blank cheque on the future. You walked into the trap, and now perhaps you will understand why I do not take you very seriously when you tell the world that the Churches, "if they maintain their influence, will sterilize scientific thought and either slow down human progress or render their adherents as defenceless against non-Christian races armed with science as were the Asiatics against the Christian races during the nineteenth century."

On the other hand, I do not regard as illegitimate all speculation as to the result in the future of certain tendencies in the present, but such speculation must be supported by evidence and argument. And, so far, you have produced

nothing which could be dignified by the name of evidence in support of these gloomy prophecies.

I am sorry you don't like my description of eugenists as pseudo-scientific cranks. I was under the illusion that I was in agreement with you. "Much of what passes as scientific psychology seems to me profoundly unscientific. The same is true of eugenics, criminology, and many other ologies." If this last sentence is supposed to be governed by the operative words "much of what passes," it is a pity that you did not state this fact more clearly. I am always getting into trouble because I assume you mean exactly what you say, e.g. that when you say "sanctity" you mean sanctity and not canonization. You must forgive me. I have been spoiled by my controversies with theologians like Father Knox.

The facts which you produce about Young are impressive. As my tastes are theological rather than scientific, I do not regard my opinions as final, and do not therefore share your reluctance to modify them in accordance with new evidence. It is clear that Young's biographer exaggerated his grievances.

And now let me sum up this part of our correspondence, before criticizing Darwinism. We claim that prejudice and ignorance are the two great enemies of the Church. Much of this prejudice is due to the illusion that the Church persecutes science. There is only one case, Galileo, of a scientist being put on trial because the Church objected to a scientific theory.

You have entirely failed to substantiate or to withdraw your general charge that the clergy burnt scientists. You have failed to produce a single case of a genuine professional scientist who was burnt for heresy. Even if we admit the one name which you mention in support of your general indictment—Bruno, as a philosopher with an incidental interest in science rather than a scientist—you are still unable to show that the Church took exception to his scientific views. Those scientists and historians who are more concerned to get at the facts than to manufacture a case admit, as Professor Whitehead and Sir John Macdonell admit, that the Church "rarely threw itself across the path of physical science."

And now for Darwinism. By way of preface let me state that throughout these letters I shall use the word "scientist" as an abbreviation for the cumbersome phrase, "the dominant scientific school of the age." I know no short, simple word to describe scientists of this school, and I hereby apologize to those scientists who, in the words of Napoleon, "have the brains to understand the faith of Charlemagne" for bracketing them by implication with their less far-seeing colleagues.

The Darwinian controversy is important for the light which it throws on the mentality of scientists and, in particular, on their anti-supernatural bias. Darwinism in the proper sense of the term is a hypothesis, for which no real evidence has yet been produced. Scientists who rejected without examination the evidence for the supernatural, accepted with uncritical enthusiasm the unsupported hypothesis of Darwinism, and some, at least, accepted it because Darwinism seemed to provide a plausible alternative to the theistic explanation of the origin of species which their anti-supernatural bias led them to reject.

Let me provide readers who are unversed in this controversy with an outline of Darwinism.

Charles Darwin was not the pioneer of the evolutionary theory. Buffon (1708 to 1788) is described by the historian of evolution, Samuel Butler, as "the father of the modern doctrine of evolution." Erasmus Darwin (1731 to 1802) and Lamarck (1744 to 1829) elaborated in far greater detail the evolutionary theory.

In October 1838 Darwin read Malthus's *Essay on Population*, and was much impressed by his presentment of the struggle for existence. It was in this struggle for existence that Darwin believed that he had discovered the eliminating agent which his theory required. The means of sustenance are limited, and the competition for these limited means is very severe. The successful competitors survive, the less successful tend to die out. Malthus had given the clue and Darwin deduced that favourable variations are preserved and unfavourable variations are destroyed. "The result would be," wrote Darwin, "*the formation of a new species.*" Here we have in outline the famous theory of Natural Selection.

The difference between Darwinism and Lamarckianism may be illustrated by the example of the giraffe. According to Darwin the long neck of this animal would be explained as follows: in times of drought or famine herbivorous animals with necks slightly longer than other individuals in that species would be able to reach the leaves of high branches which were out of reach of their less fortunate rivals. Consequently, animals with slightly longer necks have more chance of surviving than those with slightly shorter necks. The former would tend to survive and procreate offspring, and the latter to die. The process would be repeated in each generation, with the result that the average length of neck in each generation would tend to increase slightly, thus producing the giraffe in the course of geological ages.

Lamarck, on the other hand, would explain the giraffe's neck partly as the result of "use," partly as the reward of effort. The giraffe that keeps on stretching its neck develops a long neck, much as a blacksmith develops muscles in his arm. The giraffe that refuses to be beaten, that persists in trying to get the foliage just beyond its reach, will be rewarded by the acquisition of a long neck.

The great objection to Lamarckianism is the fact, if it be a fact, that acquired characteristics are not inherited. Use and disuse only affect the individual during his lifetime. The child of the blacksmith does not start life with an arm more developed than a child of yours or mine. The children of Jews whose ancestors have been circumcised for thousands of years are born without any inherited trace of this operation. Darwin's half-hearted attempt to buttress the theory of natural selection with the Lamarckian theory of the effects of use and disuse is therefore doomed to failure.

According to Lamarck the more intelligent and the more persistent giraffes select themselves, so to speak, and survive as a reward of their efforts. According to Darwin, natural selection blindly selects in each generation the giraffes who happen to be endowed, not as the result of their efforts but by chance, with rather longer necks than their rivals. According to Lamarck, the long neck is the prize awarded to the best trier at the end of the race; according to Darwin,

the long neck is the equivalent to, say, a start of fifty yards in a mile race, and it is pure chance which decides which competitors are to receive this start. "Stripped of detail," writes Samuel Butler, "the point at issue is this: Whether luck or cunning is the fitter to be insisted on as the main means of organic development."

Darwin's famous book is usually referred to as *The Origin of Species*. Its argument may be summarized as follows:

Individual members of a species vary. The variations may be slight, but they are none the less real, and moreover these variations affect the survival chances of particular individuals. Some individuals will be fleeter than others, and therefore better able to escape from their enemies. Other individuals will be slightly better protected against the cold, and will therefore have more chance of surviving an unusually cold winter. The progeny of favoured individuals will inherit the qualities which enable their parents to compete with success in the struggle for existence.

The gradual and progressive accumulation of small variations would produce first a distinct variety, and secondly a distinct species—in other words, gradually transform one type of animal or plant into a totally different type of animal or plant. In each generation the individuals who are less fitted to survive will die off more rapidly and thus presumably leave fewer progeny, whereas their slightly more fortunate rivals will live longer and consequently presumably leave a larger progeny.

Only a limited number in each generation will survive to procreate their offspring, and those which survive will perpetuate the advantages which enabled them to compete successfully. The gradual accumulation of infinitesimal differences will thus, in the course of geological time, produce all the varieties of living form. "The pivot upon which the argument for evolution rested and by which it conquered men's minds, was a train of thought, a logical syllogism, rather than an observed sequence of events in the course of Nature."[1]

A mindless environment blindly selects by a mechanical

[1] *Evolution and the Spirit of Man*, by J. Parton Milum, B.Sc., Ph.D.

process the mindless organism best fitted to survive. Intelligence, mind, and purpose are banished from the evolutionary process by this view.

Darwinism makes greater demands on our credulity than the most fantastic stories of *The Arabian Nights*. We are asked to believe that the wing of an eagle, the brain of a Newton, or the smell of a skunk have all developed by pure chance from protoplasm. The blind action of nature blindly selecting advantageous variations has produced from the original protoplasm all the glorious varieties of life.

Samuel Butler declared that he could no more believe that the adaptation of structures to needs throughout nature, adaptations of the most delicate ingenuity, were the result of gratuitous accumulation of favourable variations than he could believe that a mouse-trap or a steam-engine "is the result of the accumulation of blind minute fortuitous variations in a creature called man, which creature has never wanted either mouse-traps or steam-engines, but has had a sort of promiscuous tendency to make them, and was benefited by making them, so that those of the race who had a tendency to make them survived and left issue, which issue would thus naturally tend to make more mouse-traps and more steam-engines."

In spite of this, if Darwinism were supported by overwhelming evidence, we should have to accept it, but this is not the case. For there is no real evidence in support of Darwinism.

Again, Darwinism, even if we accept Darwin's contention, cannot properly be put forward as an explanation of natural selection, which, by definition, selects but cannot produce. Natural selection cannot produce favourable variations; at the best it can prune away unfavourable variations.

The true explanation of the origin of species is to be sought in the origin of variation, and, as Butler remarks, a man who refuses to explain variation should not imply that he has explained species. "Natural Selection," as Mr. Harris remarks, "may explain the survival of the fittest, but cannot explain the arrival of the fittest."

"In speaking of an 'explanation' of the origin of the living specific forms by natural selection," writes Professor

Driesch, "one therefore confuses the sufficient reason for the non-existence of what there is not, with the sufficient reason for the existence of what there is. To say that a man has explained some organic character by natural selection is, in the words of Nägeli, the same as if someone who is asked the question, 'Why is this tree covered with those leaves?' were to answer, 'Because the gardener did not cut them away.' Of course, that would explain why there are no more leaves than those actually there, but it would never account for the existence and nature of the existing leaves as such. Or do we understand in the least why there are white bears in the Polar regions if we are told that bears of other colours could not survive?"

Or, again, as Butler puts it, "The survival of the fittest is no more a cause of modification, and hence can give no more explanation concerning the origin of species, than the fact of a number of competitors in a race failing to run the whole course or to run it as quickly as the winner, can explain how the winner came to have good legs and lungs. What we want to be told is, not that a runner will win the prize if he can run 'ever such a little' faster than his fellows —we know this—but by what process he comes to be able to run ever such a little faster."

You open your book on evolution with a fake quotation:

"'Darwinism is dead.' Any sermon."

You might just as well, as Mr. Heseltine remarks, have said, "Any scientist," for Darwinism in the proper sense of the term is dead. Nobody still believes that the origin of species can be explained by natural selection. All that neo-Darwinists seem to claim is that natural selection may have had some influence on evolution.

My first question to you, therefore, is whether you do or do not agree that the title chosen for Darwin's book was unfortunate. Its full title was *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life.* In other words, Darwin, by this title, staked out a claim which he could not maintain; he claimed to have explained the origin of species by natural selection. The title is not *On the Origin of Species*

MAINLY by Means of Natural Selection; in other words, the title goes far to justify what you described as my travesty of his position, my suggestion that Darwinism, properly speaking, means the theory that evolution can be explained by the sole agency of natural selection. Let me mention a few of the hundreds of objections which can be brought against Darwinism:

(1) If Darwinism is true we should expect to find that the world was full of transitional forms; but the world is full of fixed types, and the five thousand years of recorded history are eloquent in their witness, not to transitional forms fading into each other, but to the stability of type.

(2) Darwinism fails to explain the evolution of very complex organs such as the eye, which consists of several parts, parts which cannot function unless they are very accurately fitted into each other. "One might possibly imagine," writes Wolff, "the adaptation between one muscle cell and one nerve end through selection among innumerable variations, but that such should take place in a thousand cases in one organism is inconceivable."

As Berg says: "The probability that all useful variations will simultaneously occur in all parts is the probability of a miracle.

"Recalling Darwin's words, it might be said, 'To admit all this is, as it seems to me, to enter into the realms of miracle, and to leave those of science. We might just as well expect that if the wheels, screws and other component parts of the mechanism of a watch were to be put into a vessel we could, by the simple process of shaking, get them to combine in such a manner as to become a watch that would function as such.'"

"*To admit all this is to enter into the realm of miracle.*"

Precisely. The only miracle which the average Darwinist was prepared to swallow with enthusiasm was a miracle for which there was no shadow of proof.

(3) Darwinism fails to explain the first origin and perpetuation of those slight variations which in their rudimentary stage are not advantageous. "How could any rudiment of an organism," asks Driesch, "which is not functioning at all, not only be useful to its bearer, but

be useful in such a degree as to decide about life and death?"

(4) Darwinism fails to explain the marvels of animal instinct. Darwin believed that evolution was a very slow, gradual process, but some of the most valuable instincts cannot possibly have evolved gradually from small beginnings, for the good reason that many instincts, notably those of the predatory wasps, would have been useless in any but their most perfect form. "Instinct developed by degrees," said Fabre, with reference to the wasps, "is flagrantly impossible. The art of preparing the larva's provisions allows none but masters and suffers no apprentices; the wasp must excel from the outset or leave the thing alone."

(5) Selection, according to Korschinsky and others, so far from favouring the development of new characters, tends to eliminate aberrations which deviate from the norm. "Far from being an instrument for the evolution of species," writes Delage, "it [selection] guarantees their fixity."

And that will do. I will not inflict on you and the reader any other arguments against Darwinism, those summarized in Berg's book, for instance. You who have read Berg's *Nomogenesis* are impressed by it. Moreover, there is no point in flogging a dead horse. Darwinism, in the proper sense of the term, is as dead for you as it is for me.

Darwinism, as I have said, properly speaking, means, in so far as it means anything at all, the theory that evolution can be explained by the sole agency of natural selection. I have already quoted the title of Darwin's book, a title which implies that the origin of species is to be explained solely "by means of natural selection." Again, in the concluding sentences of his book *The Variations of Animals and Plants under Domestication* he elaborated a striking metaphor in which he compared natural selection to a human builder.

Natural selection, Darwin argued, may be said to create new species out of fortuitous variations as truly as a man may be said to create a building out of the material provided by stones of various shapes.

The human builder who uses stones of various shapes is

solely responsible for the shape of the building. Natural selection, therefore, if Darwin meant anything by this analogy, is solely responsible for all new species.

I maintain that this view is the essence of Darwinism. I agree that Darwin was inconsistent, and that it is, as Butler pointed out, easy to find in his works quotations in support of almost every theory of evolution. I was much amused by the quotation which you hurled at my head to prove that Darwin had been influenced by Lamarck. So far from denying this fact, I had explicitly asserted it elsewhere.[1]

I should be intrigued to discover how you could justify your own definition of Darwinism, the theory that evolution can be explained "*largely* as the result of natural selection." Why call this theory Darwinism? The older evolutionists allowed for the influence of natural selection. "The movement of Nature," writes Buffon, "turns upon two immovable pivots—one the illimitable fecundity which she gives to all species, the other the innumerable difficulties which reduce the results of that fecundity and leave throughout time nearly the same quantity of individuals in every species." Mr. Patrick Mayhew explicitly advanced the theory that evolution is largely due to natural selection. You objected, quite rightly, to my attributing to Copernicus the credit for the theory usually known as the Copernican theory. Why, then, do you describe as Darwinism the belief that natural selection has played an important role in evolution? Neither this belief, still less the theory of evolution itself, can be rightly described as Darwinism. Darwinism, if any intelligible sense can be given to that term, can only mean the theory that the origin of species can be explained, not mainly but, as the title of his book implied, solely by means of natural selection.

However, I concede you a point. I should have written: Darwinism does not mean, as the vulgar assume and as that eminent scientist Sir Arthur Keith implies, the theory of evolution. It does not mean, as Professor Haldane implies, the theory that natural selection has played an important role in evolution, for there is nothing distinctively Darwinian in such a belief. No intelligible meaning can

[1] See *The Flight from Reason*, p. 54.

be attached to the many theories which Darwin put forward that evolution can be explained by the combined action of natural selection with use and disuse, for if the principle of use and disuse be adopted it is superfluous to invoke the aid of natural selection. It is true that Darwin, realizing the absurdity of Darwinism, was inclined to hedge, and never came down definitely in favour of the theory that natural selection is the sole agent of evolution. None the less, he approximated to this belief as close as he dared. He implied this belief in the title of his book and in the comparison between the work of natural selection and the work of a human architect, a comparison which would have been pointless had not Darwin believed that natural selection was as omnipotent as a human architect in the control of his creation. Finally, it was the hope of explaining away the evidence of design by natural selection, that is, by chance, rather than by means of the unpopular theistic hypothesis which transformed so many atheistic scientists into Darwinists more extreme and more logical than their hesitating leader.

In any case, "travesty" is a strong word to describe the difference between "sole agent" and "most important agent." And if we poor laymen go wrong about Darwinism you must remember that it is the Darwinists that are to blame. It is impossible to extract from Darwin's own works or from the works of his admirers a simple intelligible definition of Darwinism. Sir Arthur Keith, for instance, has written a book on Darwinism, in the Forum Library, which I am sending you under a separate cover. In this book the word "Darwinism" is used throughout as the equivalent of "evolution." A small section is devoted to "Reasons for rejecting Darwinism." The reasons mentioned are reasons for supposing that man's mental achievements "cannot be explained in terms simply involving matter and energy," a problem which has no real bearing on the Darwinian controversy. Never once throughout the book is the reader allowed to suspect that the case for evolution might be proved without in the least affecting the case against Darwinism. Not one argument, not one, against Darwinism as such is dimly alluded to from one end of the book to the other.

I wish you would explain Sir Arthur Keith to me. Frankly he puzzles me. He is, I believe, an eminent scientist. He is, I assume, a man of intellectual integrity. He would not willingly write what he knew to be false. He *must* know that Darwinism is not the same thing as evolution. He *must* have heard, however vaguely, of the arguments whereby eminent evolutionists have sought to disprove Darwinism. Once again I suppose it is a case of some "obscure instinct" which has led him wrong. A short section of his book is devoted to proving that the spirit and soul are manifestations of the living brain, just as the flame is the spirit of a burning candle, from which Sir Arthur deduces that the soul does not survive death. Surely even Sir Arthur Keith knows the answer to that jejune argument. Incidentally, is the flame "the manifest spirit" of a burning candle, and what precisely does Sir Arthur mean by "spirit" in this connexion? But perhaps it is unfair to expect the scientist to define the exact meaning of the terms which he employs in a philosophic excursus.

I do not criticize Sir Arthur for putting forward an argument which, however stupid, has convinced him, but I do object to the pretence so common among popular scientists of parading private opinions as if they were the assured result of scientific research. Sir Arthur implies that "medical men" have gone into this business of the soul very carefully, and have been compelled by the facts to deny its survival. Does Sir Arthur really believe that there are no Christians in the B.M.A., and if he does not believe this, why does he imply that he does?

This book from first to last is characteristic in its crude simplifications and in its refusal even to mention facts which contradict its main thesis, of the kind of stuff which is foisted on the credulous public in the name of science.

Please try to forget that you are holding a brief for modern science, and do give me your real opinion. Do you or do you not agree that Sir Arthur Keith has travestied Darwinism—for it is a travesty to represent Darwinism as evolution?

You mention Darwin's contributions to other sciences. It is not my business to arrange biologists in order of merit,

nor do I possess the necessary knowledge to express an opinion on Darwin's contribution to botany and geology. I should be more impressed by your tribute to Darwin if I did not feel that you were restrained by *pietas* from realizing Darwin's weak points. One need not, however, be an expert to follow the Darwinian controversy. The main arguments on both sides can be grasped by the layman. Nor need one be a scientist to distinguish between good writing and bad, between arguments lucid and confused, logical and illogical.

I do not recognize in Darwin a master mind. He does not impress me as Whitehead, Eddington, or Berg impress me, to name three modern scientists selected at random. He seems to me to belong to an entirely different order of ability. A good observer, no doubt, but a fact collector rather than a fact co-ordinator, a bad writer, and a weak reasoner.

If he was, as you suggest, one of the most eminent of scientists I am forced to the reluctant conclusion that there is more justification than I had suspected for a passage in one of Mr. Belloc's books which reads as follows:

"*Anyone can, with patience, do scientific work.* It demands no individual, still less any rare, talent.

"The result of this is that intellectual ability critical or creative will be at a discount among scientists, for fame is in every form of activity a criterion of success. To excel in playing the violin, or in majestic architecture, or in lovely painting, or in verse, you must possess exceptional qualities. . . . But anyone of common mental and physical health can practise scientific research, whether in physics, or biology, or history, or literary documents.

"Anyone can try by patient experiment what happens if this or that substance be mixed in this or that proportion with some other under this or that condition. Anyone can vary the experiment in any number of ways. He that hits in this fashion on something novel and of use will have fame. . . . The fame will be the product of luck and industry. It will not be the product of special talent.

"And there is another consequence of all this. Since the most famous scientist need not have any intellectual claim

to fame, the chances are that he will be an ass like you and me. But, being famous, his opinion will be reverently sought on a host of matters where it is worthless, and especially on the nature of the universe, of morals, of society, where he has no sort of standing; and here he will challenge, in his innocence, such giants as Suarez and Aquinas whom he has never read."

The longer that Darwin thought about it the less he liked the one feature in the theory of evolution which he believed to be original.

You have only to read his laboured reply to Mivart's criticism to realize how ill at ease he was. He found it difficult to resist the attraction of the Lamarckian theory, and inclined to buttress the effects of natural selection with the effects of use and disuse and inherited habit; but he never did justice to Lamarck, for the good reason that, once he had come down boldly on the Lamarckian side of the fence it was all up with Darwinism as an epoch-making discovery. In moments of confidence he asserted that Lamarck was no good; at other moments his writing is definitely Lamarckian. One moment, for instance, he expresses surprise that the case of ants working by inherited instinct had not been brought as a demonstrative argument "against the well-known doctrine of inherited habit as advanced by Lamarck." At an earlier stage of his career he refers to nature as "making habit omnipotent and its effects hereditary"—pure Lamarckianism.

The Lamarckian tendency is kept in its place throughout the body of *The Origin of Species*, but comes into its own in the last chapter.

Darwin was uneasily conscious of the fact that a man who professes to explain the origin of species ought to explain the origin of those variations on which natural selection is supposed to act. But, though conscious of this fact, he never faces up to it. And the result is confusion.

How do these variations arise?

"In living bodies," writes Darwin, "variation will cause the slight alterations." In other words, variation will cause variation. How illuminating! He continues: "Generation will multiply them almost infinitely and natural selection

will pick out with unerring skill each improvement." How can the blind process of pure chance be described as picking out variations with unerring skill? Skill is the opposite of chance. Here we have a good example of Darwin's silly habit of personifying natural selection and of attributing to it the characteristics of the Creator. Samuel Butler selected from different editions of *The Origin of Species* the fortuitous variations of a sentence which indicates Darwin's hesitating advance towards the personification of natural selection. In the 1859 edition we read:

"Further we must suppose that there is a power always intently watching each slight accidental alteration."

In the 1861 edition natural selection makes its coy appearance between brackets, and the passage reads:

"Further we must suppose that there is a power (natural selection)," etc.

In the 1869 edition we read:

"Further we must suppose that there is a power represented by natural selection," etc.

As Butler says: "Mr. Darwin probably said 'a power represented by natural selection' instead of 'natural selection,' only because he saw that to talk too frequently about the fact that the most lucky live longest as 'intently watching something' was greater nonsense than would be prudent even for him to write, so he fogged it by making the intent watching done by 'a power represented by a fact' instead of by the fact itself. As the sentence stands it is just as great nonsense as it would have been if 'the survival of the fittest' had been allowed to do the watching instead of 'the power represented by' the survival of the fittest; but the nonsense is harder to dig up, and the reader is more likely to pass it over."

As an example of Darwin's reasoning powers the following may be quoted: "Why, if species have descended from other species by fine gradations," Darwin asked, "do we not everywhere see innumerable transitional forms? Why is not all Nature in confusion, instead of the species being, as we see them, well-defined?"

Darwin replies that nearly every species either preys on or serves as prey for other species. "In short, as each

organic being is either directly or indirectly related in the most important manner to other organic beings—we see that the range of the inhabitants of any country by no means exclusively depends on insensibly changing physical conditions, but in a large part on the presence of other species, on which it lives, or by which it is destroyed, or with which it comes into competition; and as these species are already defined objects, not blending one into another by insensible gradations, the range of any one species, depending as it does on the range of others, will tend to be sharply defined."

"Here we have a *petitio principii*," remarks Professor Kellogg. "The sharp definition of species, that we started out to account for, is explained by the sharp definition of other species!"

Darwin's lack of logic is again evident in his remarks about theism.

He confesses that he is "impressed by the impossibility of conceiving this immense and wonderful universe, including man, with his capacity for looking far backwards and far into futurity, as the result of blind chance or necessity. Thus reflecting, I feel compelled to look to a first cause having an intelligent mind in some degree analogous to that of man; and I deserve to be called a Theist. This conclusion was strong in my mind about the time, as far as I can remember, when I wrote *The Origin of Species*, and it is since that time that it has very gradually, with many fluctuations, become weaker. But then arises the doubt—Can the mind of man, which has, as I fully believe, been developed from a mind as low as that possessed by the lowest animals, be trusted 'when it draws such grand conclusions' . . .? But then with me the horrid doubt always arises whether the convictions of man's mind, which has been developed from the mind of the lowest animals, are of any value or at all trustworthy. Would anyone trust the convictions of a monkey's mind, and are there convictions in such a mind?"

A clear thinker would never have been guilty of such inconsistent reasoning. If Darwin was not prepared to trust his mind when it drew the "grand conclusion" that God existed, why was he prepared to trust it when it drew the

depressing conclusion that a mind of such bestial origin could not be trusted to draw any conclusion at all?

Darwin's mind at different periods of his life led him to two firm convictions: (*a*) that God exists, and (*b*) that man is descended from the lower animals.

If, as the result of (*b*), he lost confidence in his own mental processes, he might well have rejected both beliefs, but to retain the latter belief, which was the source of his scepticism, and to reject the former was illogical. It was, indeed, absurd to state on the same page that he "fully believed" in the bestial origin of his own mind, and that this same bestial origin did not entitle him "fully to believe" in anything.

In your next letter I hope you will answer the following questions:

1. How would you define Darwinism?
2. Are you a Darwinist?
3. Is there any experimental evidence for the emergence of new characters as the result of natural selection?
4. Which would you prefer of two theses of which the first fitted every known scientific fact and of which the second fitted many scientific facts but was difficult to reconcile with other scientific facts?

Yours truly,
ARNOLD LUNN.

XIV.

WAS LAMARCKIANISM THEISTIC?

16 Park Village East,
London, N.W.1.
April 28, 1933.

Dear Lunn,

Before I answer your last letter, may I ask you a question. You say that some scientists accepted Darwinism because it "seemed to provide a plausible alternative to the theistic explanation of the origin of species." You go on to contrast Darwinism with Lamarckianism, to the advantage of the latter. Is Lamarckianism a theistic hypothesis? If so, where does God come into it? If it is not, scientists accepted Darwinism rather than Lamarckianism for some other reason. Will you please tell me what is *the* theistic explanation of the origin of species. Do you mean the theory of the first chapter of the book of Genesis, that on the third day of creation God commanded the earth to bring forth plants, on the fifth day commanded the waters to bring forth marine animals and birds, on the sixth day commanded the earth to bring forth terrestrial animals (all which commands were fulfilled), and on the same day made man? Or do you mean the theory of the second chapter, according to which the birds were formed from the ground? Or some other theory? Please let me know what is the theory which my bias makes me reject. The theory generally held by theists in Darwin's time was that the species now existing were created by God substantially as we now find them, which seems the obvious deduction from either of the Biblical stories.

May I take this opportunity to answer your remarks about Sir Arthur Keith? The third chapter in his book is entitled "Modern Critics of Evolution." It appears to be a somewhat altered reprint of an article in *The Nineteenth Century and After*, replying to two other articles in that periodical by Mr. Bonner and Professor Fleming. One section of this is called "Reasons for Rejecting Darwinism." In this he deals with Bonner's and Fleming's reasons. You cannot expect him to deal with all anti-Darwinian arguments in

twenty-four pages! Bonner's and Fleming's arguments would also hold against some other evolutionary theories. But they are certainly arguments against Darwinism. In the same way many of the arguments against Christianity are valid against Islam. But if you, for example, defend theism, I do not accuse you of dishonest argument if you say that you are defending Christianity.

Sir Arthur Keith's metaphor about the flame being "the manifest spirit of a burning candle" is at least historically and etymologically justifiable. "Spirit" originally meant breath, which early civilized men (e.g. the writer of Genesis) identified with life. Breathing is the taking up of oxygen and the giving out of carbon dioxide and water vapour. This is what the burning candle, as well as the breathing man, does. The flame, like the man, gives out heat. It preserves a fairly constant form, though the matter in it is constantly changing. It can reproduce itself by lighting other candles, and so on. The comparison is a fair one, though of course it cannot be pushed too far. You also object to his statement that "medical men can find no grounds for believing that the brain is a dual organ—a compound of substance and spirit." Perhaps you will later tell me what facts of medical science support this view.

You ask me whether I agree with you that Sir Arthur Keith has travestied Darwinism. I do not. He does not, as far as I can see, define it in the volume in question. I do not agree with all his deductions from it. But why should I? Still less do I agree with the opinions which you attribute to him. For the life of me I cannot see how he has travestied Darwinism. But I will give you a point. In a volume where Darwinism figures so largely he might well have made clear just what he meant by that word.

J. B. S. Haldane.

XV.

THEOPHOBIA

May 4, 1933.

DEAR HALDANE,

My quarrel with Sir Arthur Keith is that while pretending to refute the arguments against Darwinism he does not even dimly allude to a single argument against Darwinism, but concentrates exclusively on the defence of evolution.

I accept your analogy, but I assure you that the author of a book entitled *Christianity and what It Implies* would receive a severe drubbing from reviewers if he never once referred to Christ, and confined himself to defending theism.

Had Sir Arthur compared the candle flame to a spirit I should not have grumbled, but he said that the flame "*is* the manifest spirit of the candle," which is nonsense. A clear writer realizes the distinction between analogy and a statement of fact.

Medical research could add nothing to the arguments for or against immortality. The sentence I quote from Sir Arthur Keith is, if true, irrelevant, and even if true in fact is doubly false in implication, for it implies first, that all medical men reject immortality, and secondly, that medical research has weakened the case for immortality.

My attempt to explain where Darwin differs from Lamarck was not designed as a defence of Lamarckianism. Indeed, I explicitly stated that if, as seems to be the case, acquired characteristics are not inherited, Lamarckianism is clearly untrue. I described Lamarckianism to substantiate the view that Lamarck set up in Darwin's mind a complex, and that the faults of Darwin's book are due to the resulting conflict between his desire to repudiate Lamarck and the desire to accept without acknowledgment Lamarck's main theory.

The theist is under no obligation to explain the origin of species beyond asserting that the world and all that therein is was created by God.

Some Christians accept Genesis as accurate history; others

do not. My own view is that Genesis is the expression of eternal truths in immortal poetry, just as Darwinism is the expression of ephemeral folly in the medium of dreary prose.

You have challenged my view that the enthusiasm with which Darwin was accepted may be explained to some extent by the anxiety of scientists to discover a plausible alternative to the theistic explanation of the origin of species. You will find in the works of many scientists statements which imply that Darwinism has refuted Paley's argument from design. May I quote the opening paragraph of a long chapter which Paley devotes to the eye?

"I know no better method of introducing so large a subject, than that of comparing a single thing with a single thing: an eye, for example, with a telescope. As far as the examination of the instrument goes, there is precisely the same proof that the eye was made for vision, as there is that the telescope was made for assisting it. They are made upon the same principles; both being adjusted to the laws by which the transmission and refraction of rays of light are regulated. I speak not of the origin of the laws themselves; but such laws being fixed, the construction in both cases is adapted to them. For instance, these laws require, in order to produce the same effect, that the rays of light, in passing from water into the eye, should be refracted by a more convex surface than when it passes out of air into the eye. Accordingly we find that the eye of a fish, in that part of it called the crystalline lens, is much rounder than the eye of terrestrial animals. What plainer manifestation of design can there be than this difference? What could a mathematical instrument maker have done more to show his knowledge of his principle, his application of that knowledge, his suiting of his means to his end; I will not say to display the compass or the excellence of his skill and art, for in these all comparison is indecorous, but to testify counsel, choice, consideration, purpose?'

Paley argues that it would be no more difficult to believe that a watch represented a mere chance aggregation of matter than that the human eye, so exquisitely adapted to the purpose which it serves, is not the creation of an intelligent being. The popularity of Darwinism was due very

largely to the fact that Darwin was thought to have refuted Paley. "The old argument from design in Nature," wrote Darwin, "as given by Paley, which formerly seemed to me so conclusive, fails, now that the law of Natural Selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by man. There seems to be no more design in the variability of organic beings, and in the action of Natural Selection, than in the course which the wind blows."

Darwin's scientific contemporaries started with a definite bias against theism. "If you can realize," writes Mr. Shaw, himself a product of and a reaction from Irish Protestantism, which has many affinities with Calvinism, "how insufferably the world was oppressed by the notion that everything that happened was an arbitrary personal act of an arbitrary personal God of dangerous, jealous and cruel personal character, so that even the relief of the pains of maternity by means of chloroform was objected to as interference with His arrangements which He would probably resent, you will understand how the world jumped at Darwin."

Perhaps, but the jump was by no means a "logical necessity."

It is irrational to jump at atheism merely because one rejects with relief a particularly unpleasant and a particularly stupid interpretation of theism.

Theophobia is a bias no less powerful than the bias which you attribute to Christianity. Huxley, for instance, began by disbelieving in evolution. He met Darwin some years before *The Origin of Species* was published and expressed his belief "in the sharpness of the lines of demarcation between natural groups and in the absence of transitional forms with all the confidence of youth and imperfect knowledge."

By 1857 Huxley, we are told, "was feeling that some working hypothesis must be found respecting the origin of known organic forms to replace the untenable separate creation theory." And this explains the enthusiasm with which Huxley flung himself into the fray on Darwin's behalf. Huxley never fully accepted Darwinism. None the less he

clung to Darwinism, not because he believed in it, but because it provided "a working hypothesis," or, to put it more accurately, an excuse to reject the untenable hypothesis of a separate creation.

Why "untenable"? Neither philosophy nor science can be said to disprove the possibility of a separate creation.

Scientists, when they invade the territory of the philosopher, are too often guilty, as in Huxley's case, of assuming what it is their business to prove.

"We must assume Natural Selection to be the principle of the explanation of the metamorphoses," wrote Weismann, "because all other apparent principles of explanation fail us, and it is inconceivable that there should be another capable of explaining the adaptation of organisms *without assuming the help of a principle of design.*"

The italics, which are Weismann's, emphasize the horror with which he contemplated the appalling alternative.

We must accept, so he argues, a theory which we have every reason to distrust because the only alternative implies the existence of God.

We must assume. And yet it was the Victorians who contrasted the theologian who assumes with the scientist who proves.

Another example, this time from Delage, professor of comparative zoology at the University of Paris.

Professor Delage was reluctantly compelled to reject Darwin's theory of natural selection as the explanation of evolution, but he hastens to add: "Whatever may befall this theory in the future, whether it is to be superseded by some other theory or not, Darwin's everlasting title to glory will be that he explained the seemingly marvellous adaptation of living things by the mere action of natural factors without looking to a divine intervention, without resorting to any finalist or metaphysical hypothesis."

What *does* this mean? "Darwin's everlasting title to glory" is the fact that he was wrong? There is nothing particularly glorious in providing the atheist with a plausible excuse for his ignorance.

"Whoever does not place all activity wholesale under the

sway of Epicurean chance," writes Du Bois Reymond, "whoever gives only his little finger to teleology, will inevitably arrive at Paley's discarded 'Natural Theology,' and so much the more necessarily, the more clearly he thinks and the more independent his judgment. . . . The possibility, ever so distant, of banishing from nature its seeming purpose, and putting a blind necessity everywhere in the place of final causes, appears, therefore, as one of the greatest advances of the world of thought, from which a new era will be dated in the treatment of problems. To have somewhat eased the torture of the intellect which ponders over the world-problem will, as long as philosophical naturalists exist, be Charles Darwin's greatest title to glory."

Du Bois Reymond, like Professor Delage, apparently believed that a scientist establishes a good title to glory by misleading the public. Perhaps he is right.

Yours truly,

ARNOLD LUNN.

XVI.

DEFENCE OF DARWINISM

16 Park Village East.
June 8, 1933.

Dear Lunn,

You begin your attack upon Darwinism with a false dichotomy. Scientists fall into three classes:

1. Those who have not the brain to understand the faith of Charlemagne.
2. Those who have the requisite brain and hold the faith.
3. Those who have the brain, understand the faith, and do not hold it.

You appear to neglect the existence of the third class. You write of "scientists who rejected without examination the evidence for the supernatural," forgetting that until the last few years all scientists were brought up to a religion. Those who have rejected it may be assumed to have examined its claims.

Your quotation from Belloc merely proves that (not for the first time) he has written glibly on a subject of which he is extremely ignorant. I happen for the last eleven years to have been engaged on supervising young workers in science. A great many highly intelligent and industrious young men and women are incapable of research. Belloc seems to think that persistence and luck, though not enough to explain evolution, will explain scientific research. The chance of making an important discovery to-day by mixing substances chosen at random in random proportions under random conditions is about the same as that of making a Limerick by choosing words at random out of the dictionary and placing them in a random order. A few discoveries seem to have been made by this method in the late Middle Ages. They are not so made at present. We choose our substances, our proportions, and our conditions, according to a hypothesis, and we are very lucky if even once in ten times our hypothesis leads to any interesting result. Mr. Belloc's scientific methods might work if research, like

evolution, were an affair involving millions of millions of individuals, and thousands of millions of generations. But it is not. It is a purposive affair, and a great deal more rapid than evolution. I shall be glad to put a room in a laboratory and some of the cheaper chemicals and apparatus at Mr. Belloc's disposal for as long as he wishes if he desires to test his hypothesis. Or you can have a try if you like! Till then you need not expect me, or anyone else, to take this sort of attack seriously. And your approval of such ridiculous statements is bound to lower the estimate of your critical faculties by readers who are acquainted with science.

In your sketch of Darwinism you omit what many people regard as Darwin's most important contribution to evolutionary theory. This contribution, made jointly with Wallace, is the accumulation of very large series of facts supporting the hypothesis that, in Wallace's words, "Every species has come into existence coincident both in space and time with a pre-existing closely allied species." This hypothesis must be true of any theory of gradual evolution. There is no reason why it should be true on a theory of successive special creations. In *The Origin of Species* Darwin devotes Chapters X to XIV to arguments tending to prove that evolution has occurred, and which would be equally valid on any theory as to why it has occurred.

Next let me clarify matters by answering your four concluding questions.

1. I should define Darwinism as the theory that evolution has occurred (i.e. that various groups of organisms have come to differ greatly from their ancestors), and that the directions of evolution have been largely determined by natural selection.

2. I am a Darwinist, as I am a Daltonist or a Harveyist. That is to say, that I think that Darwin, like Dalton and Harvey, was on the whole right, though he was certainly wrong on a number of points.

3. "Is there any experimental evidence," you ask, "for the emergence of new characters as the result of natural selection?" Clearly there can be no experimental evidence. Experiment, unlike observation, is an interference with

nature. The selection which occurs during an experiment is not natural selection. Artificial selection can certainly give rise to new characters. In my last paper, with Miss de Winton, in *The Journal of Genetics* (copy enclosed), you will find plenty of examples of new characters arising by artificial selection. For example, the peculiar strap-shaped bracts of the plants in Fig. 35 arose from the bringing together of four genes which were present in small numbers in our original population. We found the result of their combination quite surprising. When we find that two related species differ by a number of genes, and that the combination of these genes produces a character in one which is absent in the other, we can justly frame the hypothesis that the slow process of natural selection, acting over many thousands of years, has produced effects similar to those produced by artificial selection in five or six.

4. Of two theses, one of which fitted every scientific fact, while the other fitted many, but was irreconcilable with some, I should of course prefer the former. But I should like to insist on the word "fit." No fact is known as to the movements of the planets, which disproves the hypothesis that they are carried round by angels. Several are known which are irreconcilable with Newton's laws. (Some of these latter have been cleared up by Einstein.) Nevertheless, I prefer the Newtonian to the angelic theory, because the former can be tested and found to be nearly true. The angelic hypothesis cannot be tested, but it fits the facts so loosely that it does not interest me. Indeed, no astronomical observation could formally disprove it. And a theory which no possible fact could disprove is either a logical axiom or worthless. Darwinism is open to many possibilities of disproof. A human skeleton found embedded in the old red sandstone would be enough for me. It would be rather fun to write a novel like Guy Thorne's *When It was Dark*[1] based on the theme of a wicked Christian who faked a disproval of it in this manner.

Now let me deal with your objections. Some of them are mere verbiage. You speak (for example) of a mechanical

[1] A novel in which a wicked atheist forged an inscription to show that Joseph of Arimathea had hidden Jesus' body, thus purporting to disprove the resurrection.

process selecting a mindless organism. When a lion kills the slowest of a herd of zebras, is the process purely mechanical? You say it is. I think the lion kills because he is hungry. I also think that the zebra has a mind, even if the grass which he eats has not.

Your first real argument is that Darwinism does not explain the origin of the fittest. It need not. Heritable variation is an observed fact. Natural selection is another. Darwin argued that the two together would explain evolution, as Newton argued that gravitation and inertia (persistence of motion) would together explain planetary movement. It is obvious that if no organisms ever perished, and all could reproduce freely, all the existing species would be present amongst a countless number of misfits. But on a finite planet there is only room for a limited number of organisms. Natural selection purports to explain why, of the countless possible numbers of organisms, only a few have survived.

Darwin did not explain the origin of variation, any more than Newton explained the cause of gravitation. Just as Einstein has gone some way to explaining gravitation, so Mendel and my eminent colleague and friend Muller have gone some way to explaining the origin of variation. But Darwin was perfectly justified in accepting it as a fact. His attempts to account for it were failures.

If you have only room for a finite number of organisms, natural selection will explain why those actually found are fit. If the evolutionary process (explicable by natural selection) which led to the ancestors of the horse losing their two outer toes had not occurred we should not have had a population of three-toed animals ready for the next evolutionary step, the reduction of two more toes to vestiges. There might have been one three-toed animal among millions of five-toed. In a finite world there would not have been a three-toed race.

Or let us take Driesch's case of white bears. Darwinism does not, and need not, explain why there are white bears in the polar regions. It has to explain why all (or almost all) polar bears are white, and very few other bears. Actually white animals occur as rarities in coloured species, but

except in snowy regions they are generally at a disadvantage. The occurrence of white variants is an observed fact, one of the group of observed facts on which the Darwinian theory is based.

As for the cause of heritable variation, that is a separate problem, which is to-day being very vigorously attacked. All the existing evidence goes to show that "spontaneous" variation is not, on the whole, in a direction making for increased fitness. It could not possibly (as the adaptation of different organs has been) be regarded as showing purpose or design.

Hence I do not agree that Darwin's title was unfortunately chosen. In the absence of natural selection there would be, as I think, a welter of intermediate forms. Natural selection has seen to it that only those few types survive which are adapted to their environment and whose parts are adapted to one another. It has served to delimit species by encouraging specialization. The only exception to this generalization is that, in a few cases (all, so far, in plants), it appears that a species has come into being suddenly by hybridization. The geological record, however, suggests very strongly that such cases are rare, at least among the dominant animal types. I now proceed to your numbered objections:

1. You say that you would expect to find the world full of transitional forms. You do, if you look. Where a transitional form can survive in competition with more specialized forms it does so. Let me give you a list of a few of the transitional forms between men and the fish from which they are believed to have been evolved. Of course none of these forms are exactly like the ancestral ones, but they have not evolved very far away from them.

(1) Lungfish, which normally breathe with gills, using their lungs in time of drought.

(2) Newts and salamanders, which have four legs, but must live in water or a moist climate.

(3) Lizards, which have got fully away from water, but still waddle and lay eggs, and are cold-blooded and scaly.

(4) Egg-laying mammals, warm-blooded and hairy, such as the platypus.

(5) Viviparous animals with no placenta, which must therefore bring forth their young very inadequately formed (e.g. opossums).
(6) Primitive placental mammals, producing fully formed young (e.g. shrews).
(7) Lemurs.
(8) Tailed monkeys.
(9) Tailless apes such as the gibbon and chimpanzee.

In addition we know of innumerable transitional forms which are extinct. For example, there were animals with the reptilian type of skeleton; but standing off the ground on their legs.

You say that existing types have not changed appreciably in the last five thousand years. Of course not. Nor in the last fifty thousand. But evolution has taken at least five hundred million, probably a thousand million years. You cannot expect to see much change in one hundred thousandth of that time. To observe large changes you need a series of fossils stretching over millions of years. In this case change, often steady and continuous, is perfectly obvious.

2. You bring forward the objection that Darwinism fails to explain the evolution of very complex organs such as the eye. You say that its various parts cannot function unless they are accurately fitted into each other. But they do! My cornea and lens do not give a very accurate focus on my retina, so I wear specatcles. I could live without spectacles at the cost of a slight loss of fitness. This frequent incomplete adaptation is just what one would expect in an organ whose evolution is probably not yet finished. In a state of nature I should be at a slight disadvantage, and a very myopic man still more so. I have dealt with the question of an organ whose different parts evolve under the influence of different genes in my book on evolution (pp. 100–4, 174–6, 189–93). I have pointed out that its evolution is bound to be slow, but may be sure for all that. Unfortunately the argument is mathematical, and verbal arguments against it are bound to carry weight with people who have not the time to follow the mathematics of pp. 174–6, or Fisher's discussion of the same topic, on which mine is modelled.

If the eye consisted of a thousand independently variable parts, all of which had to fit more or less adequately, then their fitting would deserve the title of a miracle. But actually things are not like that. For example, if an organ grows larger its blood-supply is automatically increased. Again, the eye is formed before its bony socket, and largely determines the form of the latter, and so on. The question then is, "How many variables in the specification of the eye, which must alter together to produce an improvement in its function, are independent heritable characters?" If you can prove to me that there are a hundred, I must of course abandon Darwinism. If there are only ten, we should expect them all to vary together in the same harmonious manner from the average, once in 2^{10}, or 1,024 individuals, which would be enough to account for their evolutionary change in parallel during geological time. Personally I suspect that ten is an over-estimate.

3. You object that "Darwinism fails to explain the first origin and perpetuation of those slight variations which in their rudimentary state are not advantageous." Darwinism does not, as I have said already, have to explain the fact of variation. But things have been made vastly easier for Darwinians by the discovery (mainly due to Bateson) that variation commonly does not take place in infinitesimal steps. If you had given me a concrete case to illustrate your objection I should, I confess, have found it easier to answer.

4. As for instinct, you must not expect me to take Fabre for gospel. Other workers, particularly Roubaud and Rabaud, have examined the same insects as he. As the result of their work, to quote Wheeler,[1] "Fabre and Bergson's contention that the solitary wasp is a clairvoyant surgeon with an intuitive knowledge of the internal anatomy of the particular insect on which it preys, may be dismissed as a myth." I quote Wheeler because, being a Lamarckian, you are more likely to listen to him than to a Darwinian. Actually in the behaviour of solitary wasps we can trace all sorts of compromises as regards the methods of feeding larvae. Thus *Synagris spiniventris* provides each egg with

[1] *Social Life Among the Insects.*

a large number of caterpillars when these are common, and then seals it up. But if caterpillars are rare the larva is provided with them one at a time. And so on. I agree with you that some of Fabre's stories would be hard to square with Darwinism if they were confirmed. But they have not been confirmed.

5. As you remark, selection on the whole eliminates variants of all kinds. Probably it eliminates almost all variants which occur in a species thoroughly well adapted to its environment. But if you alter the environment this is no longer so. If you expose *Drosophila* (a small fly) to high temperatures, you find that variants which are normally at a disadvantage become more viable than the wild type. So a population in which they occurred would begin to evolve. I quite agree with Korschinsky that selection plays an important part in keeping species stable. I would go further and say (with Darwin) that it has played an important part in originating them by weeding out intermediate forms such as occur when species are crossed.

As you point out, Darwin got into difficulties when he attempted to account for the origin of variation. It is just on this point that we can now supplement his work. In *The Causes of Evolution* I have given an all too brief summary of our knowledge on this subject. Roughly speaking, the origin of heritable variation appears to be twofold. In the first place it is due to the formation (usually in accord with Mendel's laws) of new combinations of genes found in the parents. In the second place it is due to the origin of new genes, a phenomenon called mutation. The first process obeys the laws of probability, or, as Butler called it, luck. It is in the second, if anywhere, that a theistic evolutionist would look for the hand of God. But mutation is so far from being a directed process that its results are generally harmful. And it occurs so infrequently that it could not (except in a very few special cases) direct evolution into paths other than those determined by selection. Mathematical proofs of this have been given by Fisher and myself. For this reason, although Darwin did not know what his successors know about the causes of variation, I consider that he was substantially correct as to the causes of evolution.

I am rather more of a Darwinist than Darwin, because I think that habit has played a less important part in evolution than he ascribed to it.

Having dealt with your detailed objections, or rather sketched the arguments by which they can be met, I will give an equally brief sketch of the chain of reasoning by which I should attempt to establish a neo-Darwinian position:

1. It is an historical fact, demonstrated by geology, embryology, and so on, that evolution of some kind has occurred. I take it that you do not dispute that this is highly probable.

2. Heritable variation is an observed fact of nature. Populations of one species showing great heritable variation may be in equilibrium.

3. The only causes which have been found to upset such equilibria are:

(*a*) Random survival. This only operates on small populations, e.g. of Pacific islands.

(*b*) Mutation. This is extremely feeble compared with selection, and does not make for progressive evolution.

(*c*) Selection. This is an observed fact, both in natural conditions and among domesticated organisms. On the latter it is known to be very effective.

4. The differences between species are largely if not wholly of the same character as those between members of the same species.

5. It is therefore reasonable to conclude that natural selection has been an important agency in producing evolution.

6. Until phenomena inexplicable on these lines have been described, or some other evolutionary agent detected at work, it may be regarded as the principal agent.

I must thank you for putting so clearly your objections against Darwinism, and wish that I had space to meet them in detail. It is perhaps worth remarking that if you were right and I were wrong on all these points the evidence that evolution has occurred would remain quite unaffected. We should be very much in the dark as to why it had occurred,

but there would be no more reason than there is now to suppose that the existing species were created.

As for Darwin's originality, I am quite aware that the idea of natural selection goes back to Lucretius, and do not doubt that it occurred to others before Darwin, even though I cannot discover it in the passage you quote from Buffon. Darwin's originality consisted in welding that idea with the known facts concerning variation, and those concerning evolution as an historical process, into a reasonably consistent whole. It was not quite consistent—few theories are —but it carried conviction, and is very far indeed from being dead to-day.

You refer to my quotation "Darwinism is dead" as a fake. When I read such a paper as *The Church Times* (*fas est et ab hoste doceri*) I constantly learn that Driesch or some such person has disproved Darwinism, and that evolution cannot be explained without a directing mind. I have certainly heard and read sermons to this effect.

I concede you the point that Darwin used anthropomorphic metaphors too freely. It is a vice hard to avoid if one has had a religious upbringing. But otherwise I do not agree with your criticism of his reasoning powers. In particular you object to him changing his mind. For example, he once thought that nature made the effects of habit hereditary, a view shared, but not originated, by Lamarck. He later saw that if this were true worker ants would have the habits of their ancestors, queens and drones, but not of workers. The argument about fixity of some species being due to the fixity of others (which I consider a weak one) tends to show that the formation of species is a cumulative process. The more species are clearly marked off the stronger will be the tendency for new ones to be so. As he brought forward other reasons (most of which you thoughtfully omit) for the formation of species, the additional argument which you present is perfectly valid. But I do not claim that Darwin was a good philosopher, though I would back him as a philosopher against St. Thomas as a chemist!

You devote many pages to an explanation of the unconscious motives which, as you suppose, have led men and women of science to their present beliefs. This sort of

posthumous psychoanalysis has become a literary fashion in the hands of Mr. Lytton Strachey. Go on with it. It is an excellent substitute for reasoning. Don't worry too much about the other fellow's argument, but tell the world of the moral lapses (e.g. plagiarism and boycotting), of which you consider him guilty. But what would you say if, in arguing against Catholic theology, I pointed out that it was mainly the work of men and women who had not led a normal sexual life, and was therefore suspect? You would say I was flying from reason.

You tell me, on the authority of Shaw, the high priest of irrationalism, that Darwin's contemporaries started with a bias against theism. I doubt it. They had all been brought up in that theory. The arguments for it had been put before them. Those against it had been kept from them. They had been threatened with hell-fire if they doubted it. You might as well say that a modern Russian child was brought up with a bias in favour of theism!

The main reason why men jumped at Darwinism from the design theory was that it explained so many more facts. It is unintelligible that the whale should have a vestigial pelvis and the python vestigial legs (both useless) if they were designed for their present habits. It is at once intelligible if their ancestors walked. Many traits of human behaviour which, on the theistic hypothesis, had to be attributed to the devil, are understandable as relics which were useful to our animal ancestors. Embryology is still less intelligible on the creation theory. Why should you and I have had a sizable tail and a coat of thick hair before our births if our ancestors were created without them? But if our ancestors had them, these facts can readily be explained.

Given such facts (and there are thousands of them) and the evidence for evolution from the geological record, scientists naturally jumped at a theory which explained them. Even if Delage were right, and Darwin were wrong about natural selection, he would have been of great historical importance in having produced a theory which could be tested. Ptolemy's theory of the planets was wrong, but it was of immense value because it gave a fairly good basis for prediction, and could be tested, as the angel theory

could not. Here I must admit to a possible source of prejudice. For the last fourteen years I have been one of those engaged in developing the mathematical side of this puerile theory, as Mivart called it. The question under what conditions evolution will occur appears to my puerile mind to be very difficult, involving, for example, the solution of non-linear integral equations. Indeed, I think that the theory cannot be profitably discussed without mathematics. Unfortunately people who have tried both say that the mathematics involved are stiffer than Einstein's. Now I feel that a theory like Darwinism which has inspired so much research, and led to so many discoveries (mostly observational and experimental, not mathematical), is not quite worthless, because, even if it were proved untrue, it would have led to the discovery of a great deal of truth.

The objections to Paley's argument are three. The proof that the telescope was made for assisting the eye can be obtained by asking a maker of telescopes. But the maker of eyes, if he exists, does not answer the questions of ordinary folk. Secondly, the eye at best possesses a number of faults which are remedied in good optical instruments, such as chromatic aberration. And most eyes possess inherent defects of a more serious kind. No respectable telescope-maker would make a series of instruments with as many optical defects as a group of human eyes taken at random. This is why many people who are unconvinced by Darwin's arguments believe in a blind and groping "life-force" rather than an almighty designer. Thirdly, Darwin showed that natural selection offers at least a partial explanation of effects apparently due to design. Even you, I gather, only doubt its applicability to extreme cases such as the eye. Others think that the evolution of the eye is explicable by natural selection.

You constantly trot out Whitehead as a great scientist. He is a fine mathematician, and his mathematical fame rests mainly on *Principia Mathematica*, which he wrote in conjunction with Bertrand Russell. Is Russell a great scientist? If not, why is Whitehead? Would it not be truer to say that both were great mathematicians?

I had hoped that you would agree with me that "the

wafer is said to be converted into the body," because that was the opinion of St. Thomas. He posed the question "*Utrum haec sit falsa: Ex pane fit corpus Christi*" ("Whether this is false: Out of bread the body of Christ is made").[1] He concludes that the above statement is true and not false. I am sorry that you do not share his opinion.

As you have misquoted[2] my remarks about *castrati* at the Vatican I need not deal with your reply to them. With regard to sanctity I mean by that word "the rank of a canonized saint," one of its meanings given in the Oxford English Dictionary, though I admit a rare one. You, on the other hand, seem to be having some trouble with the word "scientist." All doctors, I learn, are scientists. So I suppose are all engineers, naval officers (who learn about as much science as doctors), communists who have gone through the Sverdlov University, foresters with an Oxford diploma, dentists, psychoanalysts, and pharmacists. But not Bruno, who was only a professor of astronomy, and a pioneer in that science. You wrote to Joad, "To describe him as an astronomer is ridiculous."

Finally you claim to have trapped me into a condemnation of prophecy. I said that the Churches were likely to sterilize scientific thought, because they have often succeeded in doing so in the past. I object to your saying that organized science will persecute, because it has not done so. I have not yet produced systematic evidence as to ecclesiastical persecution of science because my turn has not yet come to attack you. You have so far been attacking my opinions. In my next letter but one I propose to begin attacking yours. In this and subsequent letters I propose to show that:

1. The evidence for the existence of a creator is inadequate.
2. The belief in a creator who is both omnipotent and perfectly good is a false belief, leading to immoral actions.
3. The organized Christian Churches are at present checks on progress.[3]

Yours sincerely,
J. B. S. HALDANE.

[1] *Summ. Theol.*, III, LXXV, 8.[2] The misquotation has been corrected on the proof. [*This correction was made by the publisher and not by Mr. Lunn.*] I regret that it is now too late to answer Mr. Lunn.

[3] It was not possible for me to deal with the third point, and I was barely able to touch on the second.—J. B. S. H.

XVII.

NEO-DARWINISM

2 Albany Courtyard,
Piccadilly, London, W. 1.
July 23, 1933.

My dear Haldane,

I am impressed by your convincing reply to Mr. Belloc's claim that "anybody with patience can do scientific work."

The Paley argument may be summed up quite briefly. The eye is a very delicate instrument, the different parts of which must fit very accurately if they are to function at all, and must fit with exquisite accuracy for their owner to dispense with spectacles. The amazing accuracy of the adjustment of so many parts cannot be the result of pure chance. Every attempt to refute Paley has failed. For Paley's argument stands unless you can prove that blind chance has dominated the evolutionary process.

Paley's argument, however, is only a particular application of St. Thomas Aquinas' fifth proof, which is an argument from internal finality rather than from external design. St. Thomas, in fact, goes deeper than Paley, and if St. Thomas were living to-day he would illustrate his fifth proof by pointing out that mechanical, unguided, and undirected conceptions are inadequate to explain the fact that molecules are arranged and organized into systems, which we call organisms, and which are capable of co-ordinated function.

Your own book, *The Causes of Evolution*, is one long confession of a puzzled agnosticism quite inconsistent with your claim to describe yourself as a Darwinian. "The first five chapters of this book," you write, "have served, I hope, to reveal the depths of our ignorance." They have indeed. "But they do also reveal," you add, "the fact that our ignorance is diminishing." Perhaps, but only in the sense that we are beginning to know how little we know. Darwin believed that he had found the key to the evolutionary process; you cherish no such illusion. And remember that

your modest claim that natural selection may be one of the factors of the evolutionary process leaves Paley's argument unaffected. If the human eye can be explained, as Darwin hoped, by the sole action of natural selection, that is, by chance, Paley's argument is refuted, but, as Du Bois Reymond remarked, "Whoever does not place *all* activity wholesale under the sway of Epicurean chance, will inevitably arrive at Paley's discarded natural theology, so much the more necessarily the more clearly he thinks."

Of all the ironies of scientific history, the attempt to vindicate Darwin by invoking Mendel is the most entertaining. Mendel's experiments were partially inspired by his belief that Darwin was misleading the public, and Mendel's failure, during his lifetime, to obtain due recognition, was due, as Bateson remarks, to the deplorable "neglect of the experimental study of the problem of species which supervened upon the general acceptance of Darwinian doctrine."

Mendel's success and Darwin's failure illustrate the fact that in science, as in other branches of human knowledge, the man who respects, will always beat the man who ignores, first principles. Darwin was inclined to doubt the existence of a personal God, a fundamental failure of intelligence which vitiated all his work. Mendel enjoyed advantages such as few modern scientists enjoy. Like Roger Bacon and Copernicus and many another great scientist, he had been trained in the finest of all schools, the education for the Catholic priesthood. He carried out his experiments at the expense and with the encouragement of that Church which you foolishly represent as the enemy of science.

Darwinism, in the proper sense of that much-abused term, is a poetic fiction unsupported by a single solitary admitted fact. From the welter of evolutionary theories provoked by the desire to support or to refute Darwinism, one clear-cut discovery alone emerges, a discovery which is easily checked, and which is universally applicable—the discovery of a monk who spent part of his day on his knees, and part of his day studying the common or garden pea. Darwin was buried among the plaudits of the world in Westminster Abbey; Mendel died in obscurity. Even

to-day some scientists are still attempting, by means of Mendelism, to salvage something from the Darwinian wreck. Very, very amusing.

If you were forced to admit that Darwinism is dead you would have to concede a point to the enemy. Consequently you still describe yourself as a Darwinist. But let us compare your beliefs with Darwin's.

My references are to your book, *The Causes of Evolution.* You reject (1) Darwin's belief, which is essential to his system, that variations due to environment are inheritable (page 18).

You reject (2) Darwin's view that variations directly produced by environment are competent to explain the known facts of evolution (page 111).

You reject (3) Darwin's belief that new species arise by natural selection (p. 139). You contend that the species which have arisen by unknown causes must justify their existence before the tribunal of natural selection. "But that is," as you say, "a very different matter." It is indeed. Please note that you have in effect rejected Darwin's claim to have *explained* the origin of species. For you have thrown overboard Darwin's belief that new species arise by natural selection.

You reject (4) Darwin's belief that evolution is a slow, gradual process. Your theory of evolution depends on sudden mutations.

But more fundamental, however, than these differences between yourself and Darwin is (5) the fact that Darwin believed that natural selection was a beneficent and progressive agency, whereas you entertain no such hopes.

"As natural selection," wrote Darwin, "works solely by and for the good of each being, all corporal and mental endowments will tend to progress towards perfection."

"Most evolutionary changes," *you* write, "are degenerative. The histories of progress are exceptional. . . . The study of evolution does not point to any general tendency of a species to progress" (page 153). "The usual course taken by an evolving line has been one of degeneration (page 167)."

"This preservation of favourable variations," writes

Darwin, "and the rejection of injurious variations, I call natural selection. . . . We may feel sure that any variation the least injurious will be destroyed."

"The fallacy is," *you* write, "that natural selection will always make an organism fitted in its struggle with environment."

If it be, as you say, true that "most mutations lead to a loss of complexity," it is difficult to understand how evolution has occurred at all. Evolution is usually regarded as evolution from the simple to the complex, from unicellular forms of life to man, the crown of creation.

It is impossible to conceive a greater contrast than the contrast between the confident dogmatic optimism of Darwin and the wistful, puzzled, pessimistic agnosticism of Haldane. You call yourself a Darwinist, but the sole point of contact between you and Darwin would seem to be the blessed words "natural selection."

"We know little," you write, "of what is actually selected, and any attempt to give a concrete account of natural selection at work must be decidedly speculative." And not only speculative, but as frequently false. Here is a case in point.

"In the wild state," you write, "a broody hen is likely to live a shorter life than a non-broody one, as she is more likely to be caught by a predatory enemy while sitting. But the non-broody hen will not rear a family, so the genes determining this character will be eliminated in nature." On which Mr. Heseltine commented (*English Review*, July 1932), "Now the broody hen does, in fact, make special and uncommon use of mimicry, or 'camouflage,' and she is also much more alert and combative than the non-broody or less broody. A broody hen has been known to kill a kestrel, a broody swan is a far tougher proposition to predatory man than a non-broody. And a ready example of a non-broody bird in nature whose genes do not seem to come to much harm is the cuckoo. However, this criticism of the example does not pretend to invalidate the argument. But it gives a fair sample of the speculation, or guesswork, applied to the results of numerous pieces of research-work quoted in support of Professor Haldane's theses, and those of evolutionists

generally. *It discloses a weakness for jumping to conclusions that has become so prevalent as to pass uncriticized amongst modern scientists.* It would be an exaggeration to say that there are 'innumerable' examples of this, for that is a word that means less to Professor Haldane than to one more cautious, but there are certainly very many."

The italics are mine.

Darwinism is supported by no single shred of genuine evidence. I dispute, by the way, your definition of Darwinism. Darwinism is *not*, as you state, the theory "that various groups of organisms have come to differ greatly from their ancestors." This theory was held for centuries before Darwin by Catholic theologians among others. There is no possible justification for befogging the public mind by describing this very ancient view as Darwinism. Darwinism, in the only intelligible sense of the term, is the belief—and even this belief was not first formulated by Darwin—that natural selection is by far the most important agent in the evolutionary process. For this belief there is no evidence whatsoever. Darwinism has now been enthusiastically defended and hotly attacked for nearly eighty years, and the upshot of this controversy is the complete rejection of Darwinism in the proper sense of the term.

You cite a few experiments which suggest that new characters emerge as the result of artificial selection. But I cannot see what conceivable bearing such experiments have on the Darwinian theory. To the survival of the fittest under conditions of natural selection Darwin attributed the evolutionary process. If we re-shuffle the genes by interbreeding, certain new characters emerge, not as the result of the survival of the fittest, which is Darwinism, but by some unknown process which remains unexplained. Of course if evolution is true new characters must appear at one stage or another as the result of crossing, but why you should trot out an experiment which merely suggests that evolution is not a myth as evidence for the Darwinian theory of evolution I cannot tell. Surely you must know that there is no reason whatever to suppose that natural selection over a long period will produce similar effects to artificial selection over a short period. Berg, whom you

admire, has exposed the fallacy of arguing from artificial to natural selection. "Natural and artificial selection," he writes, "are two different things. . . . The creative side of selection is found in artificial, not in natural selection."[1]

Darwinism, like other heresies, befogs the mind of those who are infected by it.

The reader will understand what follows more easily if he remembers that Darwinism was supposed to explain, not only the minor changes in a species, but also the great evolutionary steps, such as the transformation of a reptile without wings into *archaeopteryx*, the oldest known bird, which possessed a perfectly developed wing. Darwinism is the theory that natural selection explains the evolution of a wingless reptile into a bird. Darwinism is *not* the theory that natural selection occurs. Natural selection is one of the most obvious facts of everyday experience. Every epidemic is a case of natural selection; the unfit perish in epidemics, and the fittest survive.

Unfortunately the Darwinist is very fond of using the words "natural selection" to mean things which are quite different—(*a*) the obvious fact that unfavourable conditions tend to destroy, and favourable conditions to perpetuate a type; (*b*) the theory that this process has a creative power.

"The assertion is still sometimes made," you write in your book, *Possible Worlds*, "that no one has ever seen natural selection at work." Who made this assertion? Only a fool could possibly make such a statement, unless it was clear from the context that the words "in the production of new characters" were implied. Every epidemic is a case of natural selection at work.

You continue: "It is therefore perhaps worth giving in some detail a case recently described by Harrison. About 1800 a large wood in the Cleveland district of Yorkshire containing pine and birch was divided into two by a stretch of heath. In 1885 the pines in one division were replaced by birches, while in the other the birches were almost entirely ousted by pines. In consequence the moth *Oporabia autumnata*, which inhabits both woods, has been placed in two different environments. In both woods a

[1] *Nomogenesis*, 51 ; see also pages 65, 325, and 400.

light and a dark variety occur, but in the pine wood over 96 per cent are dark, in the birch wood only 15 per cent. . . . The reason for the difference was discovered on collecting the wings of moths found lying about in the pine wood, whose owners had been eaten by owls, bats, and nightjars. . . . The whiter moths, which show up against the dark pines, are being exterminated, and in a few more years natural selection will have done its work and the pine wood will be inhabited entirely by dark-coloured insects."

I should be grateful if you would tell me:

1. Why you considered it worth while to explain that badly camouflaged moths have less chance of surviving than well-camouflaged moths?

2. What conceivable bearing your moth illustration is supposed to have on the Darwinian controversy?

May I complete our discussion of Darwinism with a few remarks about the general problem of evolution? Evolutionary changes might be classified as major or minor. The changes within a species (i.e. the variations of the horse from *Eohippus* to *Equus*) might be described as minor evolution, and the transformation of species (i.e. reptile into bird) as major evolution. I have no doubt you can suggest more impressive terminology, but until you do you will, I hope, allow me to talk about major and minor evolution.

My first quarrel with your school is that you persist in assuming that major evolution can be deduced from minor evolution. But this is not the case. God might have created the different species and permitted them to evolve during long periods of time. The evidence for minor evolution is overwhelming, but the evidence for major evolution is extremely unsatisfactory. It is difficult to account for the absence of intermediate forms between, say, the reptile and the bird.

I am amused by the *petitio principii* in your last letter. You tell me that it is easy to find intermediate forms, "if you know where to look for them," and you proceed to construct in the best Haeckelian tradition a pedigree for man. When I ask for transitional forms I expect to be provided with forms recognizable as such, not a series of arbitrary

forms ticketed as transitional in accordance with the preconceived pedigree which it is your business to prove.

Archaeopteryx, the parent bird, has certain reptilian characteristics, but there is no sign of transition about his fully developed wing. If evolution be true, we should expect to find a series of intermediate forms between the wingless reptile and *Archaeopteryx*. We should expect to find intermediate forms clearly recognizable as such, that is, reptiles with flappers, reptiles with elementary wings, etc. The process of transforming a reptile into a bird probably lasted for millions of years, and many millions of such intermediate forms must have existed. They have, however, left no record on the rocks. But though the rocks are mute, scientists are eloquent. Mr. Pyecraft, who is a great authority on living birds, and apparently an even greater authority on birds which never lived, gives us a careful, scholarly, and scientific description of the inner digits of Pro-aves, "axillary membranes," etc., and of the precise fashion in which Pro-aves changed his overlapping scales into something like the quills of a modern bird.

The picture of this mythical bird, Pro-aves, in this book is not labelled "hypothetical reconstruction," but "one of the Pro-aves." "One of the . . ." I like that touch, which suggests that the Pro-aves depicted is only one of many whose fossils which can be studied at the Natural History Museum. I doubt if many readers realize that Mr. Pyecraft is describing a purely imaginary creature, of which neither feather, fossil nor bone has survived. Faith may be a virtue for Christians; it would seem to be a necessity for evolutionists.

You will remember Mr. Chesterton's description of *Pithecanthropus*. "People talked of *Pithecanthropus* as of Pitt or Fox or Napoleon. Popular histories published portraits of him like the portraits of Charles the First and George the Fourth. A detailed drawing was reproduced, carefully shaded, to show that the very hairs of his head were all numbered. No uninformed person looking at its carefully lined face and wistful eyes would imagine for a moment that this was the portrait of a thigh-bone; or of a few teeth and a fragment of a cranium."

All this, as Boule remarks, is so much "pithecanthropomorphism."

In 1922 a single imperfect molar tooth was found in a Pliocene stratum at Nebraska. Professor Osborn, the distinguished palaeontologist, identified it as the tooth of an ape which had evolved a considerable way in the direction of man. The ape was christened *Hesperopithicus*, hereinafter termed "Hespy" as a mark of affection. Dr. Gregory, another eminent scientist, examined Hespy's tooth and came to the considered, careful, and scientific conclusion that Hespy was much nearer a man than an ape.

Hespy was accordingly elected to that distinguished club, the Missing Link Club, and received a warm welcome from the Chairman, *Pithecanthropus*.

Meanwhile Hespy's "discoverer" was becoming quite lyrical on the subject of Hespy's tooth, and all that this tooth meant for progress and humanity. "The earth," exclaimed Professor Osborn with that shrill note which is characteristic of scientists in the pulpit, "the earth speaks loudly and clearly of the ascent of the bird from one kind of reptile, and of humans from another kind of reptile. . . . The earth spoke to Bryan (a disbeliever in evolution) from his own State of Nebraska. The *Hesperopithicus* tooth is like the still small voice, this sound is by no means easy to hear . . . this little tooth speaks volumes of truth. . . ." So it did, but not to Osborn. The "still small voice" suddenly decided to speak up, and the tooth turned out to be the tooth of a bear, and poor old Hespy was expelled with contumely from the Missing Link Club. A like fate appears to be in store for the latest member of that Club, *Sinanthropus*.

I am impressed not only by the imagination of scientists, but by their plucky determination to have it both ways. When we ask why Pro-aves has left no record on the rocks, we are reminded that the geological record is necessarily very incomplete. But the whole case for evolution rests on the assumption that the records are sufficiently complete to assume with certainty that there were no human beings in the Mesozoic age, and that reptiles appeared before birds, birds before men. The anti-evolutionist is not

allowed to appeal to the imperfections of the geological record in support of his view that nothing can be deduced with certainty from any sequence of fossils. It is, as M. Quatrefages remarked, very curious that "so many of the facts which tell against the evolutionary theory should have been preserved in these scraps of nature's books which remain to us, and that those which would have told in its favour were recorded in lost volumes and missing leaves."

Again, the evolutionist first dates his fossils from the rocks, and then proceeds to date the rocks from the fossils. *Equus*, for instance, must not be allowed to leave a visiting card in Miocene strata, because it would never do for a descendant to appear in rocks older than those which contained his reputed ancestors. In India, however, *Equus* was inconsiderate enough to appear in rocks which had been classed as Miocene in the geological map. The map was hastily revised, and the rocks assigned to the Pliocene period in order to suit the exigencies of the evolutionary theory. The horse was forced to reconcile his pedigree to that assigned to him by the American Museum of Natural History.

The troublesome habit which fossils display of turning up in the wrong rock has led to strange results. In the Alps, for instance, we are asked to believe that the older rocks have been dislocated to make way for younger rocks. "Immense mountain masses are said to have been detached from their roots and pushed horizontally over the surface of older rocks, without disturbing them in the least." As Mr. R. G. McConnell, of the Canadian Survey, remarks, "With such a convenient device as the 'overthrust' at his disposal, it is hard to see how any possible concrete sequence of fossiliferous strata could contradict the preconceptions of an evolutionary geologist." As Professor Price remarks, "The diagrams that have been drawn to account for the strange order of the strata are worthy to rank with the similar ones by the Ptolemaic astronomers picturing the cycles and epi-cycles required to explain the peculiar behaviour of the heavenly bodies in accordance with the geocentric theory of the universe then prevailing."

"The mountains skipped like rams," would seem to be

the Psalmist's intelligent anticipation of the contortions which mountains would be required to assume in order to adapt their strata to the evolutionary hypothesis.

Again, the similarities of the extinct American *Equus* and the extant European *Equus* are difficult to understand whether on the Darwinian or the Neo-Darwinian hypothesis. It seems absurd to suppose that two independent lines of descent could have terminated in two different continents in the same identical type. Consequently the evolutionist, not content with making the mountains skip like rams, calls upon the sea-floor to rise at his bidding in order that *Equus*, our friend the horse, may pass from one continent to the next on dry land. "Modern geologists, however," as Professor O'Toole remarks, "are beginning to resent these arbitrary interferences with their science in the interest of biological theories. Land bridges, they rightly insist, would be demonstrated by means of positive geological evidence and not by the mere exigencies of a hypothetical genealogy. Whoever postulates a land bridge between continents should be able to adduce solid reasons, and to assign a mechanism capable of accomplishing the five-mile uplift necessary to bring a deep-sea bottom to the surface of the hydrosphere."[1]

Evolutionists may be divided into those who believe that all living things have evolved from the same parent cell (monophyletic evolution) and those who do not believe that man and a raspberry bush are descended from a common ancestor. Monophyletic evolution seems to me the least plausible of the evolutionary theories, for I find it difficult to believe that a cabbage is one of my long-lost cousins. I am vain enough to hope that the cabbage and I evolved from different ancestors.

I am a complete agnostic on the subject of evolution, and have no intention of putting forward any theory of my own. All I claim is that the available evidence suggests that this planet has at different times been the scene of tremendous creative activity, activity which I attribute to God. The theory that God created the different species, and that these species have evolved and changed during countless ages, seems to me to fit the facts better than the

[1] *The Case against Evolution* (Macmillan Company, New York).

theory of monophyletic evolution, and is contradicted by no known facts. The theory that the planets are carried round by angels is no parallel, for two reasons. In the first place, there is no evidence in support of the theory that planets are carried round by angels, whereas there is abundant evidence in support of the belief in a creative God. In the second place, the Newtonian theory of planetary motion fits far more facts, and fits those facts far more accurately, than the theory of monophyletic evolution.

The rocks do not suggest the slow evolution of one species into another. There is a distressing shortage, if not a complete absence, of transitional forms clearly recognizable as such. But you do find sudden periodic outbursts of new forms of life, and it is usually impossible, and always difficult, to find a direct link between the new type and the previous type. The new types, as Macfie points out, do not appear until "the previous types have assumed very characteristic, specialized, unchangeable, intricately co-ordinated features."

The evolutionist, in consequence, has to assume that the new type is descended not from the preceding type, but from some common ancestor. Man, for instance, is assumed to be descended not from the ape but from an ancestor common to ape and man.

But if major evolution be true, you would expect to find simpler and more direct relationships between the types in succeeding ages. It is certainly perplexing that we have so frequently to postulate the existence of a hypothetical ancestor common to the new type and their immediate predecessors.

These sudden periodic advances produced types "so unpresaged, so unexpected, so original, and so successful that they suggest prescient intervention rather than physico-chemical continuity." [1]

The argument from recapitulation is often used to reinforce admittedly weak palaeontological arguments, but this argument has been much weakened by the criticisms of Mr. de Beer, who is himself a convinced evolutionist. In his book, *Embryology and Evolution* (Oxford), he has shown that

[1] *The Theory of Evolution*, page 69.

recapitulation is at best an argument of dubious value. "There is no logical justification," he tells us, "in regarding any embryological stage as evidence of the former existence of such a stage representing an adult ancestor. Equally well might a present adult stage represent an embryological stage of an ancestor. Embryology is therefore no guide to philosophy."

In conclusion I should like to emphasize the fact that I myself am not in the least concerned to disprove monophyletic evolution. Catholics are free to accept or reject any form of evolution, including Darwinism. If monophyletic evolution were demonstrated to-morrow my own religious beliefs would be completely unaffected. All I am concerned to prove is that scientists have a very different idea of what constitutes adequate evidence from the notions common in Catholic circles. The evidence for Darwinism, properly so called, is non-existent. The evidence for monophyletic evolution is extremely slight. The evidence for the Resurrection, for psychical phenomena produced under test conditions by mediums, and for the miracles at Lourdes is extremely strong; and yet many scientists who swallowed Darwinism and who proclaim *urbi et orbi* that only the half-witted and the dishonest reject major evolution, have neither the imagination nor the courage to examine the evidence for the supernatural which transcends both in quality and in quantity the evidence for monophyletic evolution.

To sum up. I object to the mythology of Science. I object to pithecanthropomorphism. I object to fancies being represented as facts. "Palaeontological knowledge regarding man's history," wrote Professor J. G. Kerr, "is still of the most fragmentary kind. Each additional scrap becomes the subject of a voluminous literature, and the basis of an edifice out of all proportion to the foundation on which it rests, and not infrequently constructed in complete defiance of the accepted canons of morphological argument." In so far as we accept major evolution, we accept it not because the scientific evidence forces us to this conclusion, but because the mental fashion of the day makes it easier for us to believe in the evolution of all forms of life from a single cell than in a Deity who creates the different

species at different points in time. But let us at least be honest enough not to confuse prejudice with proof. "I am, however, thoroughly persuaded," wrote that great scientist and convinced evolutionist, the late Yves Delage, "that one is or is not a transformist, not so much for reasons deduced from natural history, as for motives based on personal philosophic opinions. If there existed some other scientific hypothesis besides that of descent to explain the origin of species, many transformists would abandon their present opinion as not being sufficiently demonstrated. . . . If one takes one's stand *upon the exclusive ground of the facts*, it must be acknowledged that the formation of one species from another species has not been demonstrated at all."

Yours sincerely,

ARNOLD LUNN.

XVIII.

WHAT IS A SPECIES?

16 Park Village East,
N.W. 1,
August 16, 1933.

Dear Lunn,

I note from the newspapers that you have just been received into the Roman Catholic Church. This is a considerable help to me, because I shall be able, in future, to confront you with the official pronouncements of that body, and I shall know what you mean by the word "Catholic." If the report is false, I apologize in advance for the deductions which follow if it is true, and which I may later make.

. . . . .

Let me begin to answer your anti-Darwinian letter from the end. Delage honestly admitted that in his time the formation of one species from another had not been demonstrated. Since then it has been demonstrated, notably by Müntzing in the case of *Galeopsis tetrahit*. This would seem to be an argument in favour of Delage's "personal philosophic opinions."

Perhaps, however, you would not admit this. "The changes within a species (i.e. the variations of the horse from *Eohippus* to *Equus*) might be described as minor evolution," you write. Here and throughout you use the word "species" as no one else uses it. Later you add, "The theory that God created the different species, and that these species have evolved and changed during countless ages, seems to me to fit the facts better than the theory of monophyletic evolution." It is clear from these quotations that you use the word "species" in a manner of your own. For example, zoologists distinguish eight recent species of the genus *Equus* (horse, donkey, zebras, etc.), which you apparently place in the same species. If the birds are all descended from *Archaeopteryx*, as you think (though it seems to me unlikely) the sparrow, the swan, and

the ostrich all belong to one species! This sort of thing makes a discussion on the origin of species rather difficult! Even St. Thomas, who talked some fair nonsense about species, undoubtedly thought that the horse and donkey belonged to different species. In what follows I shall use the word "species" in its usual meaning: e.g. I shall suppose that the horse and donkey, the dog and fox, belong to different species.

You proceed to divide evolution into "major" and "minor" evolution, and admit that the evidence for the latter is overwhelming. Since "minor" evolution includes such large changes as that from *Eohippus* with four toes and simple teeth to *Equus* with one toe and compound teeth, I suspect that in practice "major evolution" means evolution assumed by analogy, and "minor evolution" evolution for which there is clear geological evidence. But though you say that the evidence for minor evolution is overwhelming, you add that "the rocks do not suggest the slow evolution of one species into another." If you think that, I wonder why you believe in evolution at all. Actually you are right! Certain rocks, e.g. the English chalk, do not merely suggest slow evolution. They demonstrate it about as clearly as an historical fact not recorded by eye-witnesses can be demonstrated. If we take the *Micrasters* (small sea-urchins) at any given level, we find a population varying about a mean, as men, for example, vary in height. *Micraster* varied in its shape, the position of its mouth, the size of its lip, and so on. Go a little higher up the cliff, and the averages are a little different. The shells are rather rounder, the mouths nearer the edge, the lips larger, and so on. But the populations overlap, just as, in a tall nation like the Scottish, we find men shorter than the average of a short nation like the Swiss. But if we go far enough up, we find so great a change that there is no overlap, and any naturalist would say that we have a different species.

We now come to *Archaeopteryx*. You say it had a "fully developed wing." Really? This wing had three digits with claws apparently free, whereas in all modern birds certain of the bones are fused to give a firm support for the feathers.

The wings were much smaller than those of a modern bird of the same size. The breast-bone had no keel, such as is found in all modern flying birds, so the flying muscles must have been very weak. *Archaeopteryx* could hardly have flown a hundred yards, and its fore-limbs certainly deserve the title of "flappers." You say that intermediate forms between *Archaeopteryx* and reptiles have left no record. The extinct triassic reptilian order *Thecodontia*, from which *Archaeopteryx* was fairly clearly descended, went in for large hind legs and front limbs which were clearly little used in walking, as in the kangaroo. Some of them were so bird-like in their skeletons as to be given names like *Ornithosuchus* (bird-crocodile). As we have no record of their skin covering, but only bones, we do not know if any of them had feathers instead of scales. They may well have had them. I certainly do not see why the transformation of a form like *Ornithosuchus* into *Archaeopteryx* should have taken millions of years, but I think it quite likely that intermediate forms will be found, as they have been in other cases since Darwin postulated their existence. When he wrote the *Origin* not a single three-toed horse was known. Now we have 250 species on or near the line of horse evolution, not to mention *Archaeopteryx* (found in 1861), links between fish and amphibians, reptiles and mammals, and so on. M. de Quatrefages, by the way, died over forty years ago, and a good many of the "lost volumes and missing leaves" have turned up since his death. I shall be interested to know some of the facts which he thought told against the evolutionary theory. You tell me that the series of arbitrary forms (whatever that may mean) which I gave as transitional between fish and man, is in accordance with a preconceived pedigree. This is not the case. For example, T. H. Huxley at one time thought that mammals had been descended directly from amphibians. Since then a large number of fossil reptiles have been found which present many mammalian features. For example, they walked with their bellies off the ground, their teeth, unlike those of modern reptiles, were differentiated into incisors, canines, and molars, their skulls had many features foreshadowing the mammalian skull, and so on. It is not the business of a biologist to

prove a preconceived pedigree, but to interpret the facts presented by the geological record, with the help of comparative anatomy, embryology, genetics, and mathematics. This is what I am trying to do.

It is obvious that man is not descended from "the ape," if you mean by that phrase one of the species of apes now existing. They are not "preceding types," but contemporaries. The preceding types, some of which may have been ancestral, are now being unearthed.

As for monophyletic evolution, this is a hypothesis which I think probable. At least the arguments in its favour appear to me stronger than your argument against it, which is that you are vain enough to hope that you are not related to a cabbage. The main arguments for it are based on the startling similarity of the microscopic and chemical structures of animals and plants.

You have not, of course, discussed the status of *Archaeopteryx* on the theory that birds were not descended from reptiles, but separately created. You were right. Before the appearance of the modern birds we find this form, intermediate between them and the reptiles. Before the reptiles we find forms intermediate between them and the fish, and so on. If they were not evolved, but created by an almighty and all-knowing Being, this Being must certainly have been aware that rational creatures would regard them as evidence of evolution. In other words, the Creator was playing a deliberate trick on us, perhaps with the object of finding an excuse for torturing us eternally, a practice attributed to him by Catholics. If that is your view, let me know. If not, why (to take only one example) did *Archaeopteryx* display so many reptilian features?

Not having seen Mr. Pyecraft's pictures, I cannot judge whether your strictures are correct. I should be a little careful of criticizing him too strongly, for the simple reason that quite a lot of such "missing links" have been found, and confirmed prediction rather strikingly.

As for *Hesperopithecus haroldcookii* (to give that mythical beast his full name), I should be interested if you would give me the reference to Professor Osborn's remarks, which are new to me. The striking thing about

Hesperopithecus is that everyone concerned rapidly acknowledged the mistake. We do not base the argument for evolution on hopelessly obsolete scientific theories, as I hope to show you that Catholics base the argument for creation.

Perhaps you will tell me why you refer to bones which, so far from being missing, are preserved in museums, as "missing links," and why you regard *Sinanthropus* as irrelevant to the problem of man's ancestry (if that is what your cryptic remark means). His skulls, for there are remains of a number of him, are considerably more complete than that of *Pithecanthropus*. By the way, Black coined the name *Sinanthropus* on the basis of a tooth, and subsequently found the rest of the skull, which shows that it is not necessarily silly to base a new genus on a tooth.

"The troublesome habit which fossils display of turning up in the wrong rock" is confined to countries where elementary observation shows that the strata are violently folded. This habit does not occur, for example, in south-eastern England, where the strata lie regularly, or in the parts of the United States where most of the precursors of the horse were found.

Anyone who takes a boat along the north-eastern tongue of the lake of Lucerne can see that, if the strata there were originally flat, some of them have been turned upside down during the formation of the Alps. The order of the Alpine strata is strange. If they were laid down flat and not created as found, some of them were certainly reversed. If they were created as found, two consequences follow: first the Creator was a deceiver, and secondly geology is a useless fraud. Now geology is a highly practical science. It is indeed too practical for our present economic system. As a result of geological methods we know where to look for a given mineral, and more metals, coal, and oil, are being produced than consumed. If only the critics of geology had had the courage of their convictions they might have looked for coal under Snowdon or copper in the Chilterns. But where cash is concerned they take geology seriously enough. Just because geology is a practical science it must use palaeontological evidence to correct its mistakes. If the evidence from

the Indian miocene had been used in constructing the pedigree of the horse you would have a case against it. Actually your case is on a par with Professor O'Toole's. The horse presumably migrated from America to Europe by an isthmus situated where the Bering Strait now exists. The depth of this strait is 144 feet. Readers of O'Toole's *The Case Against Evolution* presumably think it is five miles deep. As a single earthquake may raise a beach 40 feet, the mechanism for the formation of a "bridge" exists. The "bridge" is postulated because without it it is hard to see why the faunas of North America and Eurasia are very similar, while those of Australia, Africa, and South America are quite different.

Mr. Macfie, whom you next proceed to quote, seems to me to talk a good deal of nonsense. I suppose you regard man as a new type. Before men we find various types of fossil monkey, such as *Dryopithecus*, which appear to lie near his line of ancestry. What were their "characteristic, specialized, unchangeable, intricately co-ordinated features?" None of them survives now. Their descendants are the existing monkeys, apes, and men. The amphibians evolved from fishes during the Devonian. Many of the Devonian fishes that did not become amphibians evolved into other kinds of fish. Anything less unchangeable than the features of Devonian fish I have yet to meet in palaeontology.

You are surprised at the occasional lack of intermediates. But as the fossils of land animals are only found in terrestrial deposits such as lake- and river-beds, and most sedimentary rocks were laid down in the sea, while the rocks of any given age are only accessible over a tiny fraction of the earth's surface, it is not in the least perplexing that we have so few direct lines of descent.

I don't think de Beer's book, with which I agree very largely, has seriously weakened the argument from embryology. Embryo man has gill slits because embryo fish had them. Embryo fish had them as respiratory organs. As regards the eye, you make no attempt to deal with my argument, but merely say that it has failed, without telling me how or why. The parts must fit with a rather moderate accuracy. If they fitted perfectly there would be no work

for oculists. But as, until quite recently, a severe failure of the parts to fit has been incompatible with survival, it would be a miracle if they didn't fit fairly well, provided, as I said before, that the number of independently variable specifications was small enough. Of course my argument rests on mathematics, but you might, I think, have told me where it was wrong.

Your account of my book is slightly humorous. Our ignorance is diminishing because we are learning more about the nature of the heritable differences between varieties and species, and the relative fitness of different varieties. Darwin believed that he had found the key to the evolutionary process. I also think that he did so. But I certainly do not believe in Dubois-Reymond's statement. Mendel showed that in certain cases genes were distributed at random. This is all the "Epicurean chance" which is needed to establish the efficiency of natural selection. Because I believe that genes are distributed according to the laws of probability I do not have to believe that the qualities which they determine are "under the sway of Epicurean chance." Of two brothers, one may chance to be born an idiot, the other intelligent. It does not follow that the workings of the intelligence are under the sway of chance. On the other hand, the ways in which characters are combined (e.g. whether the idiot will have blue or brown eyes) is in many cases demonstrably a matter of chance. Dubois-Reymond was one of those scientists who talked a lot and found out rather little, and I see no reason whatever for taking him seriously. It is very curious, I agree, that Mendel's work should have supplied the information needed to make Darwinism a thoroughly coherent theory. But it happens to be true. On the other hand, it is merely humorous to describe Mendelism as the one clear-cut discovery emerging from the Darwinian controversy. De Vilmorin's and Johannsen's discovery of pure lines is just as clear-cut, and about as important. So is Morgan's identification of the gene as a material object.

Now for my differences from Darwin.

1, 2. I do not agree that the belief that all variations due to the environment are inheritable is essential to Darwin's

system. This belief was the weakest point in his system, and now that we can replace it by an adequate theory of the origin of variation the rest of the system is greatly strengthened.

3. If you had read my book with any care you would realize that in the passage to which you refer I was speaking of certain allopolyploid plant species which have arisen suddenly, and not as Darwin supposed. However, this phenomenon has not been observed in animals, and will only account for the origin of a minority of plant species. In the majority of cases I adhere to Darwin's explanation.

4. I entirely agree with Darwin that in many cases evolution was a slow, gradual process. May I quote what I said concerning the geological record, as unearthed since Darwin's time. "Evolution in such cases has clearly been a very slow and almost (if not quite) continuous process, exactly as Darwin had predicted" (page 22). I suggested that in other lines there might have been bigger jumps than Darwin thought.

5. My difference with Darwin here is partly verbal. The tapeworm may be very nearly perfect of its kind, but can yet be regarded as the result of a degenerative process if it was derived from a free-living ancestor. As I point out (page 153) such words as "progress" in this case are ambiguous. So is the word "injurious," as used by Darwin. I disagree with Darwin (in the passage which you quote) in thinking that a variation which would be beneficial to the species may be rejected as injurious to the individual. Darwin modified his views later.

It seems to me that these differences are rather slight. Other scientific theories have been similarly modified. Dalton invented the modern atomic theory in the early nineteenth century. Modern chemists differ from him on the following points, among others:

1. Several of his atomic weights must be halved or doubled.

2. The Daltonian "atom" is not an atom at all, but a system of from two to ninety-three components.

3. Many elements are mixtures of atoms of several

different kinds. Nevertheless there is not a chemist alive who would not acknowledge that he found Dalton's ideas absolutely indispensable. Nothing is commoner in the history of mathematics and science than to find a proof partly invalid, but the conclusion correct. Thus Euclid's first proposition (on a given straight line to construct an equilateral triangle) gives a correct method. But he has not proved it. For he does not prove that the two circles in the construction meet. To do so we require the parallel postulate. Similarly, Darwin was, I think, wrong about the origin of variation, but when this error is corrected his main thesis holds.

My most fundamental contribution to the discussion of evolution is my contribution, with Fisher and Wright, to the mathematical proof that in a large population where variations are inherited according to Mendel's laws selection is the only agency which can lead to important changes within times measured in millions of generations. There may be a fallacy in this proof, but you have not disproved it by stating of the theory "that natural selection is by far the most important agent in the evolutionary process. For this belief there is no evidence whatever." If our theory cannot be rebutted by more solid arguments, I think that we have gone far to prove what you say is the essence of Darwinism. It might be good tactics, though hardly honest, to ignore our alleged proof in a book which you were writing by yourself. It is not tactically sound to do so in a book written jointly with one of us.

You seem to be pleased by my statement that "most mutations lead to a loss of complexity." This would be very awkward for me if I thought that mutations determined the direction of evolution. But I don't. I think that most mutant forms are eliminated by natural selection.

As for Mr. Heseltine, if he thinks that a hen in an Indian jungle is more likely to overcome her natural enemies by sitting still or fighting them than by running or flying away, I must leave his opinion to the judgment of our readers. As a non-broody hen does not usually, if ever, behave like a cuckoo, this bird is irrelevant.

I have every reason to believe that natural selection over

a long period will produce similar effects to artificial selection over a short period. I claim to have proved it mathematically. If Berg had had access to my work he might have shown that I was wrong. Until someone does so the proof stands.

Why you refer to my theory as wistful, puzzled, pessimistic agnosticism I cannot conceive. Agnosticism is the theory that some things cannot be known. I think that by sufficient experiment, observation, and calculation we can get to know about evolution. Pessimism is the theory that the world is as bad as possible. I think it might be a lot worse. I am not such an optimist as Darwin, in the passage that you quote, but this does not make me a pessimist.

You next proceed to bring up a passage from my book *Possible Worlds*, and ask various questions about it. The points which I wanted to prove were as follows: First, that protective coloration is an important advantage. This has been denied by McAtee[1] in a very lengthy paper, by Uvarov and others. Secondly, that under the influence of natural selection a natural population has changed. If this is correct it shows that in this particular case natural selection had caused just such a change as we find in successive populations of *Micraster*. The two overlap, but differ notably. Where the same process has had a longer time to act, as with many local varieties of rodents, we find no overlap. But in these cases we have not got the same evidence for a change in the population.

You take this opportunity to repeat the statement that natural selection does not produce new variations. I do not know how you define the word "variation," but I believe that it does produce new characters in a species. I need not restate the argument[2] unless you bring forward reasons to doubt it.

May I briefly restate my general position? I am quite convinced that evolution has occurred. I am also convinced that mutation and natural selection are now occurring, and have occurred in the past. I think it highly probable that

[1] *Smithsonian Miscellany*, Vol. 85, pp. 1–201.
[2] *The Causes of Evolution*, p. 94.

these together will account for evolutionary changes. The possible directions are given by mutation, the actual direction taken by selection. I do not know of any facts definitely inexplicable on this theory. There may have been other evolutionary agencies. But I am waiting for evidence of them. You talk of "tremendous creative activity." You will shortly have to defend the theory of creation. Until you have done so I remain sceptical.

However, I want to be perfectly honest, so I will tell you what I think is the main difficulty in my neo-Darwinian position. When we study well-preserved fossil lineages, e.g. oysters, ammonites, or corals, we become aware of certain slow and steady trends; for example, the appearance or disappearance of "ornaments" such as knobs and ridges, for which no selective advantage can be suggested. I find no difficulty in explaining the evolution of a useful organ like the eye. It is the apparently useless ones that worry me. They do not in the least suggest an intelligent designer, but they do suggest the operation of some agency of which we are quite ignorant. It is only my mathematical theory (in other words, my reasoning) which makes me doubt the existence of some such unknown agency. Fortunately for Darwinism we know that changes in unimportant organs are generally accompanied by changes in important ones. For example, abnormalities of the human hair and teeth often go together, being caused by the same genes. So it may be that the unimportant changes in shell pattern were inevitable accompaniments of important changes in soft parts. But that is my main difficulty, of which you may make any use you like.

I think I have now met your chief objections to Darwinism. You repeat your assertions about miracles once more. If you would only abandon the Bellman's principle you would have more paper available to prove these assertions. I apologize for the length of this letter, but I think it important to show that anti-Darwinism arguments can be dealt with. I must thank you for giving me the opportunity to do so.

Yours very truly,

J. B. S. HALDANE.

XIX.

PROOFS OF GOD'S EXISTENCE

16 Park Village East,
London, N.W.1.
Sept. 9, 1933.

Dear Lunn,

We now begin the second part of this correspondence. You have confined yourself to attacking the outlying parts of the scientific position. You have cast doubt on some sections of Darwin's theory. You have shown, what no sane man would deny, that scientists, including myself, are intellectually fallible. Our differences on these matters have been mainly quantitative. For example, you told me that Mivart and others were boycotted or ignored. It is true that Darwin's crime now turns out to have been not so much that he ignored Mivart, but that he attacked him with undue ferocity. However, I admit that scientists are only human, and their pronouncements open to question. You have never attacked the validity of scientific method, as I had rather hoped you might.

I do not propose to attack your weakest point, namely, the obvious imperfections of the Church. I may find time for that later. I want, instead, to attack where you claim to be strongest, that is to say, the central doctrines of Christianity. I could admit all your assertions, and continue to believe that I am right in practising science. You will not be able to admit mine, and go on believing that you are right in practising Catholic Christianity. I am going to choose St. Thomas as my main target, because you share the general view that he is the greatest Christian philosopher.

It is a Catholic doctrine that the existence of God can be rationally proved. Few of your other beliefs are harder to swallow. I may see a really convincing miracle tomorrow. If so I shall find it easy to believe in the others. I may find that the Church satisfies my emotional cravings. If so, I shall perhaps make an *auto-da-fé* of my rational objections to it, "an act of faith," as it is called. I may be so

overcome by the aesthetic or moral perfections of the Church as to believe that its doctrines must be true. But even if I believed in your God I should find it extraordinarily difficult to believe that my faith could be rationally grounded.

You will tell me that I believe in all sorts of much queerer doctrines, such as the quantum theory and evolution. I believe in evolution for the same sort of reasons that I believe there were men in England in the Bronze Age. But I don't believe in the quantum theory as you believe in God. I merely regard it as a good way of accounting for certain facts until a better one is found. If you said, "Quite a lot of facts are consistent with the view that the world was made by an intelligent being," I should agree, while adding that quite a lot more were not. But you claim that this theory can be proved by reason. Like such mediaeval thinkers as William of Occam, I deny your claim, and propose to examine it.

Let us be clear as to what I am examining. Not the theory that God exists. The word "God" has been used in so many senses that to disprove all the possible meanings of that theory would be as difficult as killing the Hydra. Various more or less theistic theories have been held by men who did not think that God had created the world out of nothing. For example:

1. God is doing the best He can with more or less refractory matter, being related to it like a craftsman to his raw materials.
2. God is related to the world as a soul to its body.
3. God is the absolute mind, related to the world as our minds are related to our experiences.
4. God is related to human intelligences as a universal to particulars.
5. God is a power, not ourselves, making for righteousness.
6. God is the ideal which it is the task of the world to realize.

Now, some of these doctrines seem to me much more plausible than yours; but they are quite different, and you

hold, I think, that none of them will serve as a basis for Christianity. So, unless you so desire, we will not discuss them.

I understand that you regard St. Thomas's arguments for the existence of God as adequate. I shall therefore examine them. It is required to prove that the universe was made out of nothing by an intelligent being. The alleged proofs that such a being possesses other perfections will be examined later. St. Thomas brings forward five proofs in the *Summa Theologica*, but concentrates on the first of them—the argument as to the unmoved mover, in the *Summa Contra Gentiles*. The five proofs may be summarized as follows (let me know if you think my summaries in any way unfair):

1. Some things move. Whatever is in motion is moved by something else. Hence either there is an immovable mover or an infinite series of things which move others and are themselves moved. But this is impossible. So there is an immovable mover. (The word *movere*, here translated "to move," was used by mediaeval philosophers to denote other kinds of change. However, St. Thomas was mainly concerned with change of position, as shown by his rather unfortunate choice of the sun as the example of something which everyone would admit to be in motion. I use the word "move" as the English equivalent, since it is used in the official translation by Dominican monks.)

2. Every perceptible event has an efficient cause, and no event is its own cause. If in efficient causes it is possible to go to infinity there will be no first efficient cause, and hence no ultimate effect. Hence there must be a first efficient cause.

3. Some things could either exist or not exist. But everything cannot be of this kind, because whatever has the possibility of non-existence, at some time does not exist. In this case there was a time when nothing existed, which is absurd. Hence something must exist necessarily. What exists necessarily either has its cause of necessity in itself or has not. But an infinite regress is impossible. Hence there must be something which is necessary in itself.

4. Things exhibit degrees of truth, goodness, nobility, and so on. "More," in such a case, means nearer to "most," as a thing is hotter if it more nearly approaches the hottest thing. The most complete member of any genus is the cause of everything in that genus, e.g. fire, the hottest thing, is the cause of all other hot things. So there is a cause of being, goodness, and other perfections in things.

5. Some unconscious things work for a purpose, as is evident from their acting always, or nearly always, in the same way, so as to obtain the best result. This cannot be due to chance, but must be due to intention; for unconscious things only tend to an end when directed by a conscious being. Hence there is an intelligence which orders natural objects.

Later on the prime mover, first cause, necessary being, most perfect being, and directive intelligence, are shown to possess other attributes of God.

Let us now examine the first argument, taken from Aristotle. St. Thomas observes that two things must be proved, namely, that whatever is in motion is moved by another, and that it is impossible to proceed to infinity in movers and things moved. In my opinion both these propositions are false. The first is part of Aristotle's physics, but Newton's first law is as follows: "Every body continues in its state of rest of uniform motion in a straight line, except insofar as it may be compelled by force to change its state." I do not wish to use Newton as an authority, but his laws have been very extensively verified, and unless you are going to contend that Aristotle was right and Newton wrong I shall assume the opposite. If you like I will, of course, argue the point. It might be said that even in Newtonian physics every moving body had at some past time been set in motion by some other. But this was not what St. Thomas meant. In his argument against an infinite series of movers he wrote that "every body that moves through being moved is moved at the same time as it moves." According to the Aristotelian physics the sun and planets, for example, were actually kept in motion by the *primum mobile*.

The arguments against an infinite regress are as follows:

(*a*) If it is true, an infinite number of bodies must be in motion at once, which is impossible. Why is it impossible, if there is an infinite number of movable bodies?

(*b*) If it is true, then in an infinite series of movers "there will be no first mover, but all will be intermediate movers, as it were. Therefore it will be impossible for any of them to move, and thus nothing in the world can be moved."

Now if this argument is correct, we can apply it to other series. For the best way of testing the validity of an argument is to apply a formally similar argument to more familiar material. Thus the fallacy in "No molluscs are nematodes, no nematodes have cilia, therefore some molluscs have cilia," is much clearer in "No pigs are frogs, no frogs have wings, therefore some pigs have wings." A similar transposition of St. Thomas's argument reads, "If there are an infinite number of points in a finite line traversed by a moving particle, then there will be no first point reached, but all will be intermediate points, as it were. Therefore it will be impossible for the particle to start." Now this contains two fallacies. Firstly, there are infinite series with a first member. Thus if we consider that portion of a line running east and west which is not east of a given point nor more than ten miles west of it, this segment contains an infinite number of points; but there is a first point, namely, the given one. Secondly, there are series of points with no first member, which can yet be traversed. Such are the series of points lying west, but not more than ten miles west, of the given point. For every member of this series is some distance west of the given point, and within this distance, however small, a still nearer point can be found.

St. Thomas's argument, if it were logically applied, would prove the impossibility of motion. It had been used for this purpose by Zeno the Eleatic. Now, when an argument disproves a known fact, it follows that there is something wrong with the argument. What is wrong you will find in text-books of mathematics. The modern treatment of infinite series is clearer than that of the Greeks, but if

St. Thomas had read the tenth book of Euclid's elements he would have found quite enough on the subject to give him pause. However, in the Middle Ages the Oxford mathematical course did not go beyond the fifth proposition of the first book, and I doubt if things were much better on the Continent.

(*c*) This is the same argument as (*b*), in reverse order, depending on the alleged impossibility of an infinite series of movers.

(*d*) If every mover is moved, this proposition is either true in itself or accidentally. Suppose it to be true accidentally, then it might be true that none ever was moved, in which case there would be no movement, which is absurd.

This argument being false, I need not detail the reasoning which proves that the above proposition is not true in itself, and hence that there is an immovable mover. The fallacy is, of course, that the world might be such that some movers were necessarily moved, and others just happened to be moved. In this case there would necessarily be some movement, but it might perhaps only be accidentally true that all movers are moved.

To sum up, the argument for an immovable mover, which was St. Thomas's main proof of the existence of God, rests on two false premises. One, that whatever is in motion is moved by another, is bad science. The other, that an infinite series of moves is impossible, is bad logic and bad mathematics.

The second "proof" of the existence of God is practically another version of the first. If an infinite regress of causes is possible it clearly falls to the ground.

The third again rests on a gross and obvious fallacy, that because A and B are both possible, and not necessary, there must have been a time when neither existed. If Ruritania is always ruled by a king or a queen, it is not necessary that there should be a king of Ruritania, or that there should be a queen. But there is certainly one or the other. This argument also involves the impossibility of an infinite regress.

The fourth proof is full of bad physics; for example, the theory that fire is the cause of all other hot things. What a pity the saint never saw an electric radiator worked by water-power! It contains the infinite regress fallacy in a different form. It is untrue that all series have a largest member. Further, St. Thomas forgets that a few pages on (Quaestio III, 5) he is going to prove that God does not belong to any genus, which if true, completely invalidates this argument.

All these four arguments depend on the objection felt by Aristotle, St. Thomas, and some other philosophers, to infinite series. This objection is not felt by mathematicians, who are accustomed to them. They are really quite easy to deal with, much more so than long, finite series. Thus it is clear enough that the sum to infinity of $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+$ . . . is 1. But it would take you more than a day's work to give me the sum of its first thousand terms as a decimal. It begins with 301 nines followed by a nought and 698 other digits! A mathematically trained person naturally prefers an infinite series. But although I have a bias in favour of the trained man, I do not think that one can legitimately found a system of philosophy on preferences of this sort.

St. Thomas's fifth proof is of quite a different kind. He only sketched it, but it was fully developed by Paley. It applies to two classes of natural object, namely, inorganic things and living organisms. It is claimed that these behave in a nearly uniform way, so as to obtain the best results. Such a generalization, which St. Thomas states without proving, was far more plausible in his time than ours. The earth appeared to be designed to harbour men and animals, the heavens to light them. There were a few exceptions—treacherous volcanoes, violent storms, desolating floods, and (in paynim lands only) thirsty deserts. But as a whole the inorganic world seemed to serve a series of purposes.

To-day our world-picture is very different. The earth is mostly covered by inhospitable ocean. Much of its land surface, including one whole continent, is uninhabitable. And everywhere else things are worse. Most of space is empty, most of the heavenly bodies far too hot or cold for life (at least of the kinds known to us). It is highly probable

that we men are here because our planet is one of the rare nooks in an inhospitable universe where we could possibly exist. Almost all matter serves no purpose of which we know anything. You may say that God created it for purposes of His own; but that is begging the question. It is excessively unlikely that there is life in most of the stars, yet St. Thomas, at any rate, thought that living beings were more noble and perfect than non-living. We can agree with him that the inorganic world is on the whole uniform, but not that it is purposeful. If it is so, what purpose or end does it fulfil?

At first sight animals and plants seem to be designed. Their parts are at least well enough adapted to their functions to permit of survival. But not much more so. If they had been designed they could have been better designed. If my windpipe had been behind my gullet, instead of in front I should never, or very rarely, have choked. If my intestines had been adequately anchored I should not have had hernia. If my eyes had been faultlessly designed I should not need spectacles. These defects are perfectly intelligible on evolutionary grounds. If eyes were not variable they could not evolve. My intestines are suspended in a manner which would serve me very well if I walked on all fours, as my ancestors did. The apparent design in living beings can mostly, if not all, be explained as the result of natural selection acting on mutations which show no evidence of design.

But suppose I am wrong, what sort of designer must we postulate? Here again we have the advantage of St. Thomas. He knew of animals hostile to man, such as the wolf and lion. But these had a nobility of their own, and perhaps were not hostile before Adam's fall. He did not know of the hundreds of parasitic species wonderfully adapted to their function, and serving merely to kill or cripple millions of men. Think of the worm *Bilharzia*, which is one of the plagues of Egypt. It bores its way into the urinary bladder or the rectum, and there often sets up a peculiarly unpleasant form of cancer. For thousands of years men and women had prayed to Osiris, to Jesus, and to Allah, for deliverance from this agony. *Bilharzia* carried on. In 1917

Christopherson discovered that the disease, provided cancer has not developed, can invariably be cured with antimony tartrate. Did God create this worm to torture millions of men, or merely to provide Christopherson with an intellectual problem?

I could give hundreds of other examples of the same kind. If the argument from design is correct, the designer may have been intelligent, but was not perfectly good. It would be safer not to prove the existence of God by this argument. You will not arrive at a deity worthy of Man's worship.

I have devoted a good deal of time to St. Thomas's arguments, for two reasons. They are probably the best of their kind. And you have adopted the usual Catholic theory that they are invincible. In an encyclical of 1879 Pope Leo XIII wrote: "It is well known that there have not been wanting heresiarchs who openly said that, if the doctrine of St. Thomas could be got rid of, they could easily give battle to other Catholic doctors, and overcome them, and scatter the Church." I do not regard St. Thomas as particularly difficult to get rid of; but I do not harbour the illusion that I shall scatter the Church, because it is not founded on reason, but on emotion. St. Thomas's philosophy is based on antiquated science and faulty mathematics. The clergy were quite right, from their point of view, to imprison Galileo and prohibit his books, and Cremonini, the professor of philosophy at Padua, who lectured on Aristotle's *De Coelo*, was acting in the best interests of theology in refusing to look through his telescope. He had disproved Aristotle's physics, and consequentially St. Thomas's theology. Pope Leo follows with a definitely funny remark: "Hence also the physical sciences . . . would not only take no harm from a restoration of the philosophy of the ancients, but would derive great protection from it." "Will you walk into my parlour?" said the spider to the fly.

I have dealt with St. Thomas, but as an appendix I should like briefly to consider two modern arguments which purport to prove that the universe cannot have existed for ever, at least without some breaches of the known laws of physics. They thus support the theory of a first cause or unmoved mover.

One of these is the argument from entropy. Entropy is a measurable quantity which represents, so to speak, the randomness of a configuration of matter and energy and tends to increase in any isolated system. Thus, if a hot body and a cold body can exchange heat, they tend to come to the same temperature. Mechanical energy tends to be converted into friction, and so on. So any machine which does not receive energy from outside will tend to run down. Hence the universe will "run down," and has been "wound up," i.e. brought into a state of low entropy, which is impossible as a result of physical processes. This argument is invalid for five reasons among others:

1. The universe may be spatially infinite. If so the argument from finite systems to an infinite system is illegitimate without further justification, which is as yet wanting.
2. If the universe is a finite system of a certain type, it would diminish its entropy once more within a finite (though exceedingly large) time after "running down," as a result of what is called fluctuation.
3. On certain versions of the theory of general relativity "space is expanding." More accurately, a certain length, which is characteristic of space itself, and not of any particular object in it, is increasing. If so, as Bridgman showed, apparently irreversible events, such as the radiation of heat from hot to cold bodies, are reversible, and would be reversed if the dimensions of space contracted.
4. Gamoff (the Russian physicist who produced the mathematical theory of radioactivity) has given reasons for thinking that collisions between sufficiently rapidly moving bodies are superelastic. If so there may be an inexhaustible supply of energy within some of the stars.
5. The universe, as a whole, may have properties, like those of atoms, which prevent its running down. This is quite probable if it is in any sense a living system.

According to one possible consequence of the theory of general relativity the universe is expanding. It is highly probable, on a number of grounds, that about two or three

thousand million years ago the stars were very much closer together than they are now. Eddington and others have plumped for the theory that this expansion is an irreversible process, and if we think far enough back into the past we come to a condition where the present laws of physics would no longer hold.

De Sitter, who gives a popular account of his mathematical work in *Kosmos*, points out that on the existing data an oscillatory condition of the universe is equally possible, and there are no adequate grounds for decision.

The fact is that the eternity of matter or the existence of a first cause are equally compatible with the known facts. One cannot disprove the hypothesis of creation. But there is no particular reason to hold it. And if there was a first cause we must examine the arguments by which it is equated with a personal creator.

To sum up, the arguments for a first cause, or designer, are not sufficient to carry conviction to anyone who is not already biased in favour of theism. We do not know enough, in my opinion, to prove that there was no first cause, or that there is no purpose embodied in the universe as a whole. These are open questions. But there is a very simple reason why St. Thomas's arguments are so faulty. There may have been atheists in Europe in his time, but if so they knew very well that it was unsafe to argue with a Dominican friar. His arguments on questions which were publicly debated in his day, such as nominalism and transubstantiation, were much more adequate. In consequence his system of theology is hopelessly top-heavy. It carries a vast superstructure, but its foundations will not support it.

Yours very truly,

J. B. S. HALDANE.

XX.

PSYCHICAL RESEARCH

September 25, 1933.

My dear Haldane,

You are under the impression that all our letters up to date have been devoted to attacks upon your position, and you forget how often you have attacked my belief. A single inaccurate and provocative remark calls for several pages by way of an adequate defence.

I apologize for my casual use of the word "species" in my last letter, an obvious and silly slip. There are places in my last letter where "type" was the right word. I might plead in defence that no scientist has ever succeeded in defining the boundaries between a species and a genus, and consequently it is easy to slip into the bad habit of using the word "species" freely. British brambles and roses, for instance, have been classified as sixty-two different species by one eminent authority, and have been divided into only two different species by another equally eminent authority. You know Dr. Tait Regan's definition of species: "A species is a group of animals that has been defined as a species by a competent systematist." However, you were quite right to pull me up on this point, if only to provide a touching example of the contrast between the humility with which a Christian accepts, and the anger with which a non-Christian rejects, correction on a point of fact.

I am sorry that limitations of space restrict me to commenting rather briefly on your very interesting defence of Darwinism. Let me take up one or two points. I agree with you that the difference between *Eohippus* and *Equus* is vastly greater than, say, the difference between the various changes of species in small sea-urchins, but I might add that the evidence for evolution by descent is far less strong in the former than in the latter case.

Now for *Archaeopteryx*. Professor Louis Vialleton, who is considered by some people to be the greatest comparative

anatomist of the twentieth century, violently dissents from your view that *Archaeopteryx* is an intermediate type between the reptile and the bird. Here is what he says:

"The *Archaeopteryx* as Dames and Deperat have recognized is a bird; its feathers indicate a warm-blooded animal; its behaviour was that of a non-flying bird and it could probably use its wings only as a parachute; it was a kind of abortion, one of the many aberrant forms that one sees, but it indubitably was not an intermediary between two classes (reptiles and birds) as they would like to tell us. Affinities with reptiles are not doubtful, but they are not more marked than in the case of other birds; they support the idea of the unification of the two classes in the group, *Sauropsidae*, but allowing for these *rapprochements*, it is clear that the *Archaeopteryx* helps in no way to understand how a reptile can become a bird, and especially how it could have acquired little by little and by gradations realized in the course of life the radical differences of skeleton, of locomotion, of development, of nutrition, and of thermogenesis that characterize the group of birds among the *Sauropsidae*."

Even if you deny that *Archaeopteryx* possesses a fully developed wing, you will not deny its perfect feathers. I shall be interested to know your criticisms on the following passage in Macfie's book (page 55):

"Feathers are much more than skin deep: they imply and necessitate correlated adapted changes in every part of the body and are in themselves structures so intricate, so delicate, so perfect, that even if one reptilian scale had had the luck to go through all the almost infinite changes required to turn it into a perfect feather, it is too much to believe that all the scales could simultaneously have been so lucky as not to turn into feathers but into feathers of various shapes and sizes, exquisitely adapted to each other, to the parts they cover, and to the special function they play in the part, be it legs, wings, or breast. In the monstrous and anomalous bird, the *Archaeopteryx*, we find perfect feathers suddenly appearing. There are no signs

in it or in any of its predecessors of aeons of tentative and abortive effort in feather-making, yet if feathers were the product of casual unco-ordinated variations or mutations they must have gone wrong at a million points, and the intricate and the necessary adaptations between them and the anatomy and physiology of the whole organism could never have been successfully achieved."

You point out that the *Archaeopteryx* possesses many reptilian features, such as, I suppose, its teeth. But teeth are not essential to the reptilian scheme. If *Archaeopteryx* is assumed to be descended from reptiles because it possesses teeth, you might argue that the turtle, with its toothless beak, is evolving into a bird. These affinities prove very little. Nobody, for instance, maintains that birds are descended from the reptilian *Pterosaurs*, and yet the *Pterosaurs* had horny beaks, no teeth, and other birdlike characteristics.

You tell me that the transformation of one species into another has been demonstrated by Müntzing. I should like to hear a little more about this "demonstration." This, of course, depends on your definition of "species." You can always prove your case by inventing a new species-name for a descendant who differs slightly from its ancestor, but whatever may be the case with species, the transformation of one type into another type has not been demonstrated. It remains as true as when Delage wrote that if one takes one's standpoint on "the exclusive ground of fact," major evolution has not been demonstrated at all. Even in the very letter in which you dispute this you appeal from scientific fact to philosophic pre-judgment to prove that *Archaeopteryx* could not have been a special creation of God. God, you suggest, would not be so naughty as to deceive us by producing so reptilian a bird. *Non decuit ergo non fecit.* But has He deceived *us*? Why "us"?

Personally I have no lively confidence in my ability to understand how or when or why God should create. If God wanted to create a bird with teeth I do not think He would be deterred by the reflection that you might draw false conclusions from the teeth in question.

The reaction from monophyletic evolution may be traced in a brilliant book, *Nomogenesis*, by Berg. Berg is a Russian scientist working under an atheistic Government. He cannot therefore be accused of any bias in favour of Christianity. "A strict adherence to the monophyletic principle," he tells us, "is generally bound to lead to absurdity. . . . To support the view that animals descended from four to five progenitors is now *impossible*, the number of the primal ancestors must be computed in thousands or tens of thousands."

Berg disdains the conventional appeal to the imperfections of the geological record. "It is truly remarkable that palaeontology in no way displays transitional forms between phyla and classes, and, possibly, not even between orders. Thus, we are ignorant of transitional forms not only between vertebrates and invertebrates, fishes and tetrapods, but even between the cartilaginous (chondrichthyes such as sharks, etc.) and higher fishes (osteichthyes); *in spite of a wonderful affinity between reptiles and birds, no transitional forms between them are known hitherto.* Formerly, this circumstance was accounted for by the imperfection of the geological record; but it is none the less surprising that the deeper our knowledge penetrates into the domain of fossils, the farther back recede genetic inter-relations, which, as it were, ever elude our grasp."

The italics are mine, and the italicized passage gives you Berg's view of *Archaeopteryx.*

The public would have no excuse for believing in the alleged imperfection of the geological record, were they not in effect prevented from learning the truth by an unofficial and unavowed scientific censorship far more severe than any censorship imposed at Rome.

Mr. D. Dewar, who is, I believe, admitted as an expert authority on Indian birds, and Mr. G. A. Levett-Yeats compiled some statistics which, if reasonably accurate, seem to shatter the whole case for evolution. That case, such as it is, is based on the fact that missing links will all be found in the missing volumes of Nature's books.

Mr. Dewar in his book *Difficulties of the Evolutionary Theory* gives a list of the number of genera of non-flying

land mammals which are known to have lived at various stages of the Tertiary and in the Quaternary. Eighty genera have left their fossils in the Lower Oligocene strata of Europe, but there are only forty-eight genera of non-volant land mammals alive in Europe to-day. If the fossil record is so incomplete, it is rather amazing that we find nearly twice as many fossil remains of these mammals in the Lower Oligocene as we know to exist to-day. Similar statistics are given for other geological periods. In view of these facts the failure of the evolutionist to trace the descent of *any*—please note this word "any"—of the thirty-seven non-volant land mammals which existed in the Pleistocene, but which did not exist in the Basal Eocene, is in itself almost coercive evidence against major evolution.

On any theory of gradual evolution there must be infinitely more intermediate links than stabilized types; but whereas the geological record is reasonably complete so far as the fossil remains of the great types are concerned, it is completely barren in records of the missing links. Every one of the land mammals which now inhabit Europe have left fossil remains.

Of course, I personally have no means of knowing how far these statistics are accurate, and I invite your opinion on them. Mr. Dewar, who is a Fellow of the Zoological Society, sent this paper to the Society in the hope that it would be published in the "Proceedings." The Secretary returned the paper with the following remarks: "I am sorry, but the Publication Committee cannot accept your paper. We got the opinion of a first-rate palaeontologist and geologist about it, and he told us that although it must have taken a very long time to compile it, he thought this kind of evidence led to no valuable conclusion."

Please note that the palaeontologist in question did not challenge the accuracy of the evidence. He merely *disliked* the conclusion to which it seemed to point.

Is it surprising that Professor Dwight, the well-known Harvard anatomist, wrote as follows—the italics are mine: "The tyranny of the Zeitgeist in the matter of evolution is overwhelming to a degree of which outsiders have no idea. Not only does it influence (as I admit it does in my own

case) our manner of thinking, but *there is oppression as in the days of the Terror. How very few of the leaders of science dare to tell the truth concerning their own state of mind.*"

It is perfectly true, as Mr. Dewar himself says, that "those who do not accept this creed are deemed unfit to hold scientific offices; their articles are rejected by newspapers or journals; their contributions are refused by scientific societies, and publishers decline to publish their books except at the author's expense. Thus the independents are to-day pretty effectually muzzled."

The other day I met a Fellow of the Royal Society. "I am glad you are taking up this issue," he said, "because, of course, we professional scientists can do nothing. Our hands are tied. Take my own case, for instance. Professor X regards Darwin as a Messiah. He has many good jobs in his gift, and no jobs going excepting to those who worship at the Darwin shrine."

It is high time that those of us who still believe in free thought should unite against the High Priests of Evolutionary Orthodoxy and insist that this fascinating question should be freely discussed.

If all the other arguments against evolution could be met, it would still be difficult, if not impossible, to find a satisfactory answer to the following points.

Professor Poulton must, I think, be credited with the most satisfactory definition of a species. He defines a species as an interbreeding community, a definition which I like for two reasons. In the first place it is clear-cut, and in the second place it may prevent evolutionists claiming that they have proved the transformation of species by the simple expedient of labelling two closely allied interbreeding members of the same group as different species. Take the well-known case of the hare and the rabbit. These two rodents exhibit remarkable similarities of structure and posture suggesting a common ancestor in the not too remote past. But they resolutely refuse to interbreed. "A species," as Mr. Kindersley remarks in an interesting paper read before the Victoria Institute, "with its isolating factor of sterility stands for fixed rigidity, and that spells death to

any theory of organic evolution, *since all life, vegetable and animal,* is marshalled into 'species.' That factor of sterility has never been known to be 'acquired.' It is the one determining patent of 'species' all the while open to proof."

Mr. Kindersley's name may be unfamiliar to you, for he is not an evolutionist, and he is not a professional scientist. But it is less easy to dismiss Sir William Bateson, who says: "If 'species' have a common origin, where did they pick up the ingredients which produce this sexual incompatibility (sterility)? Almost certainly it is a 'variation' in which something has been added."

Few people would really believe that evolution has been proved if the evolutionist had not confused the issue by unscientific terminology. One does not, of course, expect scientific terminology to be as lucid, as unambiguous, as precise, in a word, as scientific, as the terminology of theologians such as St. Thomas Aquinas. But when we have made every possible allowance which charity dictates for men who have not enjoyed the theologian's training in exact thought, we have surely a right to protest against the slipshod fashion with which the evolutionist habitually confuses two totally different things—changes within the framework of definite limitations and changes which transcend those limits. I think I was perhaps the first to suggest the use of such terms as "minor evolution" for the former and "major evolution" for the latter. More recently Mr. Dewar suggests that we should use the word "evolution" for the hypothesis that, say, a reptile has evolved into a bird, and the word "differentiation" for the fact that sea-urchins, over long periods, have exhibited certain minor changes.

Now, of all audacious bluffs, the attempt to trot out the evidence for a fact which nobody disputes—the fact of minor evolution—as if it were evidence for the untenable theory of major evolution, is the most audacious. Mr. H. G. Wells and Professor Julian Huxley, for instance, have headed a section of their book *The Science of Life* with the following heading, "The Continuity of Evolution as Proved by Sea-Urchins." In other words, the *conservatism* of the sea-urchins, which throughout millions of years have remained

substantially the same, is solemnly cited as evidence to prove such revolutionary changes as the change from a reptile without wings into a bird.

Thank you for your interesting account of the relation of your theory to Darwinism. We shall never stop if no one is allowed to closure any discussion, but I think you should be allowed the last word on the general question as to whether your theory is, as you claim, or is not, as I maintain, closely related to the Darwinism of Darwin.

I sent your criticism of Heseltine to Heseltine. He was at the moment desperately busy, and he could only send me in reply a few hurried pencil notes which I quote herewith:

"He does not answer my attack on his slovenly thinking, e.g. on broodiness. He knows perfectly well that camouflage in the Indian jungle or elsewhere helps a hen to *escape* her natural enemies, and he knows that she can, when she is defending her eggs, kill some enemies she would normally fly from in vain. I never said that a non-broody hen (by which he means or implies domestic hen or descendant of *Gallus bankiva*) behaves like the cuckoo. I can, however, show him hens actually doing so, i.e. laying their eggs in other hens' nests and never nesting or incubating. I gave the cuckoo as an example of a non-broody bird—and being a female bird she is a hen—and serves for exactly the same sort of analogy as he uses throughout his argument.

"This is a good instance of his typical shuffling in an argument. He says, '*Overcome* her enemies,' when I, keeping strictly and scientifically to the language of the discussion, said 'survive' (and he had used 'escape'). To substitute the word 'overcome' to suggest, as he does to the average reader, a hen fighting a tiger, is not argument. Here is a case where he is accused of the most serious scientific crime—slovenly thinking—and he runs away from the accusation."

As for *Sinanthropus*, on page 32 of Mr. Wells' book, *The Work, Wealth and Happiness of Mankind*, *Sinanthropus* is described as an ape-man below the tool-using level. On

page 53, however, we learn that just as the book was going to press, "shaped tools well above eolith" level have been found "in close association with *Sinanthropus* remains." This promotion of *Sinanthropus* within twenty-one pages from an ape to a skilled craftsman is rather rapid even for modern science.

I like your attempt to prove that *Ornithosuchus* was an intermediate between the reptile and the *Archaeopteryx*. "As we have no record of their skin covering, but only bones, we do not know if any of them had feathers instead of scales. They may well have had them." I am pleased by the unconquerable hopefulness with which you people always assume that things must have been as you would like them to have been to suit the exigencies of your evolutionary theory. Another example of this faith is your assumption that you can "postulate"—delightful word!—a land bridge between America and Europe to explain the similarity of faunas. If you would only accept the possibility of creation by a deity you would not be forced to upheave your ocean-bed to shift your fauna from America to England.

Your confidence increases as you proceed. In an earlier letter you suggest the modest claim that we "can justly frame the hypothesis" of a theory which in your last letter you claim to have proved mathematically—the theory that natural selection acting over a long period will produce similar effects to artificial selection over a short period.

As you have warned me that your equations were stiffer than Einstein's, you will not expect me to argue about your mathematical proofs, but I read this section of your book with care, and I am unconvinced that your equations throw much light on the process whereby feathers were developed out of scales.

Moreover, as usual, you beg the question. You claim to have shown that "in a large population where variations are inherited, according to Mendel's laws selection is the only agency which can lead to important changes in times measured in millions of generations." This may be so if we begin by excluding the possibility that these important changes may be due to the creative action of God.

Your defence of the passage about the moths is ingenious, but it will not do. You are in the dock charged with deceiving your readers, for though you have only succeeded in proving that white moths show up more clearly against a dark than against a light background, you have subtly conveyed the impression that this truism helps to establish the truth of Darwinism. You have confused the fact, which nobody outside a lunatic asylum could deny, that Natural Selection is a reality, with the theory, which you are trying to prove, that Natural Selection helps to transform one species into another.

Now that you are cornered you suggest that you are trying to establish the advantageous effect of protective coloration against the heresies of McAtee, Uvarov, and others. If these gentlemen really deny that white moths stand less chance of being eaten by an owl against a light than against a dark background, then indeed the scepticism of some modern scientists, where obvious facts are concerned, would seem to equal their credulity in the matter of Darwinism.

Your defence is clearly manufactured to meet my attack. In the essay in which these moths were discussed, I can find no reference to the heresies of McAtee, Uvarov, and others, nor any overt attempt to establish the truism of protective coloration. Your essay, which is called "Darwinism To-day," is an eloquent defence of Darwinism, and the simple reader is left under the illusion that your remarks have some real bearing on the Darwinian controversy.

May I at this point repeat what I have already said? Catholics are not free to believe in the evolution of man's soul, but Catholics are free to believe in any theory of physical evolution, monophyletic or otherwise. I know of one priest who is an ardent Darwinist.

Personally I am an agnostic on the subject of evolution. I object to a plausible theory being represented as an almost certain fact. I agree with Von Reincke, the great botanist, that "the only statement science can make consistent with her dignity is that she knows nothing about the origin of

man." And I agree with that very great man, the late Professor Bateson, whose works I believe you admire, that "the origin and nature of species remain utterly mysterious."

The evolutionist cannot claim to have proved his case until he has found an answer to the criticism that he assumes that the geological record is sufficiently complete to deny the existence of, say, bird fossils in Devonian strata, and yet so woefully incomplete that we can draw no sure deductions from the absence of intermediate types. In other words, the missing leaves in Nature's book would seem to contain all the evidence that the evolutionist needs to prove his case, and none of the evidence which the anti-evolutionist requires.

Father Burton, who was later Bishop of Clifton, was once challenged to explain why there is no clear reference to the doctrine of the Immaculate Conception in the works of the Early Fathers. He replied: "In operibus quae supersunt, concedo, in operibus quae perierunt, nego" ("In the works that have survived, I agree; in the works that have perished, I deny"). In other words, he appealed, as you do, to the imperfection of the record on which he based his claim. Father Burton had the makings of a modern scientist.

The reader is now in a position to estimate the quality of the evidence which you consider satisfactory in support of a belief, such as Darwinism, which fits in with your prejudices. Let us supplement our inquiry by examining the evidence for those beliefs which you reject without adequate examination because they conflict with your own *a priori* view as to how Nature should function.

Let me begin with the supernormal phenomena which have, I believe, been established by psychical research. I shall not discuss telepathy until you tell me whether you do or do not accept telepathy as proved, for instance, by the remarkable experiments of Professor Gilbert Murray. Nor shall I try to show that mediums have often shown, in trance condition, a knowledge of facts that they could not have acquired by normal means, unless you are prepared to dispute this fact.

I propose, therefore, to confine the discussion to certain objective phenomena, such as the movement of objects without contact, and the "materializations" of human forms by means of ectoplasm extruded from the body of the medium. I maintain that the occurrence of such phenomena has been proved beyond all possible doubt. I do not accept the usual spiritualistic hypothesis that we can communicate with the spirits of the dead, but I am mildly impressed by the hypothesis tentatively put forward by William James that these phenomena are the work of low-grade intelligences. I have given reasons for this view in *The Flight from Reason* (page 222).

You raise the question of fraud. Now fraudulent phenomena no more disprove the reality of genuine phenomena than forged bank-notes disprove the existence of genuine bank-notes. Just as the fact that a medium has never been convicted of fraud does not strengthen the case for the phenomena produced by the medium in question, so the fact that a medium has been convicted of fraud is no evidence against the genuineness of the phenomena produced by that medium under test conditions which preclude the possibility of fraud. No experiment is evidential if our verdict depends either positively or negatively on the character of the medium. It is the duty of the investigators to exclude all possibility of fraud. If such precautions have been taken, the phenomena produced by a medium who had previously been convicted of fraud deserve attention, and if no such precautions have been taken the phenomena are suspect, however unblemished may be the reputation of the medium.

A medium of high character will often "cheat" in a trance. His subconscious mind takes control, with the result that the medium tries to free hands or feet from a control. A patient will often struggle violently against the surgeon when he is passing under an anaesthetic. Similar convulsive movements in a trance condition present all the appearance of a fraudulent attempt to escape from control.

Your reference in the same letter to conjurers betrays your unfamiliarity with this subject; for, if you had studied

it you would not have referred to conjurers without anticipating my obvious rejoinder. And my rejoinder is this. The world's greatest conjurers have signally failed to equal, far less to surpass, the performances of the great mediums. What explanation can you offer for the fact that mediums, who in many cases are unintelligent in their normal life, mediums who have never been detected practising a single act of legerdemain, have beaten the world's greatest conjurers at their own game? Please do not evade this question.

Conjuring is a highly skilled craft, and we should certainly not expect an Italian peasant woman like Palladino, or a Welsh coal-agent like Evan Powell, to beat men like Maskelyne at their own game. The older Maskelyne completely failed to convince a British jury that he had earned the thousand pounds which Archdeacon Colley had offered to any conjurer who could reproduce materialization under the test conditions which had been imposed at the séances at which he had been present.

Mr. Harry Price made a public offer of a thousand pounds to Captain Maskelyne if he could duplicate under identical conditions the phenomena produced by Rudi Schneider, the Austrian medium, at the recently founded National Laboratory of Psychical Research. Captain Maskelyne declined the challenge.[1]

I made a similar challenge to a conjurer who visited Mürren, a challenge which he politely declined.

And now for the positive evidence. The most remarkable of all physical mediums, that is, of all mediums who produce physical objective phenomena, was undoubtedly David Douglas Home.

"A highly desirable characteristic of Home's mediumship," wrote that eminent scientist Lord Rayleigh, "was the unusual opportunity allowed to the sense of sight. Home always objected to darkness at his séances."

Home's mediumship created such a sensation that a committee was appointed by the Dialectical Society of London to investigate his mediumship. This committee, which consisted of thirty-four gentlemen of high standing,

[1] *The Flight from Reason*, pp. 206-208.

including two fellows of scientific societies, met on forty occasions, and the report which they presented caused such amazement and dismay that the Dialectical Society, who had appointed this committee in the hope that it would expose Home, refused to publish the report. The committee, however, were sufficiently public-spirited to publish their report at their own expense. Here are some extracts from the report:

"Thirteen witnesses state that they have seen heavy bodies —in some instances men—rise slowly in the air and remain there for some time without visible or tangible support."

"Five witnesses state that they have seen red-hot coals applied to the hands or heads of several persons without producing pain or scorching, and three witnesses state that they have had the same experiment made upon themselves with the like immunity."

T. H. Huxley was invited by the Dialectical Society to join this committee and continue these investigations. He declined the invitation in a petulant, foolish letter. "The only good that I can see," he wrote, "in the demonstration of the truth of 'Spiritualism' is to furnish an additional argument against suicide. Better live a crossing-sweeper than die and be made to talk twaddle by a 'medium' hired at a guinea a séance."

Huxley failed to realize that the question at issue was not whether the life of a crossing-sweeper was richer and more varied than the life of a spirit, but whether the fact of spirit communications had been proved. The spiritualist might well have rejoined, quoting Huxley's own words, "Sit down before fact as a little child, be prepared to give up every preconceived notion, follow humbly wherever and to whatever abysses Nature shall lead . . . even to the abyss of the spiritualistic heaven."

Experiences in Spiritualism by D. D. Home, by the Earl of Dunraven, contains the records of no less than seventy-eight séances at which Lord Dunraven, at that time Lord Adare, was present. The book opens with an impressive list of fifty witnesses, men and women of responsible position,

who were present at these séances, and who (with four exceptions who were inaccessible) testified to the accuracy of these reports. At these séances a variety of remarkable phenomena were recorded—the handling of red-hot coals, the phenomena of the direct voice, the playing of an unsupported accordion, levitation, etc. The most striking case of levitation occurred in the presence of Lord Adare, Lord Lindsay, and Captain Wynn. Home floated out of one bedroom window, seventy feet above the ground, and back through another window.[1]

I wish you would read this book. One is, I think, forced to accept one of two alternatives. Either supernormal facts occurred, or, alternatively, one must fall back upon complete scepticism as to the possibility of certifying facts by human testimony. Lord Rayleigh, President of the British Association, and, I think, President of the Royal Society, writes: "I find it difficult to accept what one may call the 'knave and fool theory' of these occurrences; but failing that it would seem to follow that one must admit the possibility of much that contrasts strongly with ordinary experience."

From the amazing wealth of modern evidence to the reality of psychical phenomena I will quote only one example.

Most of the phenomena of the séance room depend on a mysterious substance for which Professor Richet coined the the word "ectoplasm." The medium goes into a trance and a formless mass begins to materialize. A cloudy, filmy patch seems to emerge from the body of the medium. This gradually organizes itself into the shape of a hand, or, in rare cases, of a complete human body.

Ectoplasm has now been studied under the most rigid test conditions by scientific investigators. It has been photographed, cinematographed, and weighed. The reality of ectoplasm beyond all possibility of doubt has been proved at the Institut Metapsychique in Paris, an Institute which has been recognized by the French Government as "of public utility."

It was at the Institut Metapsychique that the famous paraffin glove test was employed for the first time. This

[1] See *The Flight from Reason*, p. 198.

test was made by Professor Richet and Dr. Geley, and the first experiments took place with the Polish medium Kluski. Dr. Geley, before the sitting began, prepared a bath of paraffin wax.

During the séance the "spirit" was requested to immerse his hands into the paraffin bath. The spirit obeyed, and the spirit hand emerged covered with a thin coating of paraffin, a fragile shell about the sixteenth of an inch in thickness.

It would, of course, be impossible for a human being to withdraw his hand from such a delicate paraffin shell without breaking it; for the hand could not pass through the narrow opening where the shell had solidified around the wrist.

The spirit then dematerialized its hand in the paraffin shell, which was therefore left *intact.*

I use the expressions "spirit" and "spirit hand" for the sake of convenience, though I am not convinced by the spiritualist hypothesis. I am content to maintain that these paraffin gloves provide unanswerable proof of the existence of some strange force of which, at present, we know nothing, which enables the medium to build up simulacra of human forms by some process which cannot be explained by fraud.

The thin paraffin shells were preserved and made permanent by filling them with plaster. The paraffin gloves have been submitted to professional moulders, who declared that they could not reproduce these gloves by any process known to them. A professional moulder who wished to obtain a mould of a hand with bent fingers would make this mould in two sections, joining the sections together. The paraffin gloves show no trace of a join.

In many of these paraffin gloves the hands are closed, the thumbs bent, and the finger-tips joined to the palm. A well-known scientist, who disbelieved in psychical phenomena, attempted to produce these paraffin gloves in his laboratory. The contrast is very striking between the swollen, shapeless shells which he produced and the delicate paraffin shells produced at the séance—shells which clearly show all the lines in the hand and which are perfect in their moulding.

The lines on the hands and the finger-prints on these paraffin moulds have been shown to be entirely distinct from the finger-prints either of the medium or of any of the sitters present at the séance. In order to prove that the paraffin shells were not manufactured outside and introduced surreptitiously into the séance room, Dr. Geley took the precaution of mixing cholesterin in the paraffin bath, which he himself brought into the séance room. After the séance concluded, he tested the paraffin gloves and satisfied himself that they had been formed from the paraffin which had been treated with cholesterin.

These paraffin gloves can be seen in the Psychic Museum attached to the Psychic Bookshop in Victoria Street, London.

The reality of ectoplasm and of many other strange phenomena investigated at these séances can only be denied by obscurantists who refuse to accept any facts which conflict with their view of the universe. Such people remind me of those learned men who refused to look through Galileo's telescope, and of the fundamentalists in the last generation who averted their eyes from the fossils in the rocks lest their interpretation of Genesis should be upset. There is a great deal in common between the simple piety of the fundamentalists and of those old-fashioned scientists who believe that nothing could possibly occur in this mysterious universe that could bring a blush to the cheeks of a respectable Victorian rationalist.

The Miracles at Lourdes

I will now ask your attention for a very brief summary of the evidence for the miracles at Lourdes.

The flight from Victorian secularism is nowhere more pronounced than in the growing tendency to admit the probability of supernormal cures. Indeed, the pendulum is swinging from scepticism to the indiscriminate acceptance of all faith cures. Nothing, for instance, is commoner than for uninstructed people to mention the miracles at Lourdes and Christian Science in the same breath.

The British Medical Association in 1909, and a committee

of doctors and clergymen who concluded their labours in 1914, examined the claims of Christian Science. Both committees were convinced that there was no evidence for the genuine cure of organic diseases. You are entitled to insist that doctors and clergymen could hardly be expected to pass an unbiased verdict on a sect which is competing with both the medical and clerical professions. To which I reply that many non-Catholic doctors who have investigated the Lourdes miracles have no rational explanation of their cures. I shall begin to take Christian Science seriously when Christian Science cures are submitted to the same scientific scrutiny that prevails at Lourdes. Lourdes is unique, for the cures at Lourdes are submitted, as no other faith cures are submitted, to a medical bureau on which doctors of every nationality, of all religions and of none, are invited to serve. Lourdes is visited by a yearly average of some five hundred doctors.

I am sending you herewith two pamphlets, *The Miracles at Lourdes* and *A Modern Miracle* published by The Catholic Truth Society, 38 Eccleston Square, S.W.1, and 28A Ashley Place, S.W.1. The latter address is just opposite Westminster Cathedral. These pamphlets, which cost 2*d.* each, can be obtained from any bookseller, and can be found in the Catholic Truth Society's rack in most churches. Nobody has any right to express opinions about miracles until he has read them.

What do you make of the case of Joachine Dehant? Dr. Froidebise gave a certificate to this patient before she left for Lourdes that she was suffering from a dislocated right hip-joint, contraction of the lateral tibial muscles so as to produce the effect of a club foot, and an ulcer covering two-thirds of the external surface of the right calf. The ulcer had lasted for twelve years, and had eaten deep into the flesh, partly destroying the muscles. Suppuration was free and the pus extremely foul. The bone itself was necrosed. The foot, lacking support, was inverted, and the knee long ankylosed in flexion. Joachine's ulcer was perfectly cured at the second bath; the foot, the hip-joint, and the knee were cured on the following day. She weighed only 4 st. 3 lb. on arriving at Lourdes; a few years after the

cure she weighed 11 st. 10 lb. "The sudden cure of a sore," as Professor Vergez of Montpellier says, "or rather a spreading chronic ulcer, in a very decayed constitution and the spontaneous reduction of dislocation of the hip are facts quite outside natural explanation."

Other cases mentioned in this pamphlet are those of Marie Lemarchand, a case of advanced lupus, and Mlle Lebranchu, "La Grivotte" of Zola's novel. Mlle Lebranchu was dying of tuberculosis, but was restored to perfect health after the first bath. Her restoration was attested by the declaration of about thirty doctors in the medical bureau. Zola could not deny that she had been cured, but in his novel he deliberately falsifies the facts and makes her relapse and die. In point of fact she had no relapse.

Other miracles are those of Madame Biré, who was suddenly cured of her blindness, which had lasted six months, and the remarkable cure of Marie Borel. For five months her faeces passed through six fistulae, which closed up spontaneously with no treatment beyond the application, with prayer, of a little spring water, in the space of twenty-four hours. The purulent cystitis of the bladder, which complicated the case, was cured at the same time.

In conclusion I ask you to examine the C.T.S. Pamphlet, *A Modern Miracle*, which describes the remarkable case of Peter de Rudder, a Belgian farm-labourer, whose left leg was shattered in 1867 by the fall of a tree. Seven years passed and the bones had not united. Peter de Rudder stubbornly resisted the advice of his doctors, who advised on amputation, and determined to ask his cure from Our Lady of Lourdes, venerated at the shrine of Oostacker near Antwerp. The doctor, Van Hoestenberghe, who was converted to Christianity by this miracle, gave his testimony in the following solemn words:

"I declare on my conscience and on my soul:

"1. I have examined De Rudder a dozen times and my last visit was two or three months before the cure;

"2. Each time I was able to make the ends of the bones

come out of the wound: they were deprived of their periosteum, there was necrosis, the suppuration was fetid and abundant and had passed along the tendons. . . .

"3. At each examination I introduced two fingers to the bottom of the wound and always felt a separation of 4 or 5 centimetres between the broken parts and this right across their breadth. I was able to turn them about easily.

"4. A large sequestrum had come away at the beginning and little bits of bone often came away during these years."

This testimony was confirmed by witnesses who saw De Rudder a few days before cure and on the way to Oostacker. The driver of the tram on which he travelled from Antwerp to Oostacker, observing the broken leg swinging to and fro, made a joke at De Rudder's expense. "There goes a man who is going to lose his leg," he said to the onlookers.

De Rudder entered the Grotto, sat down on a bench and prayed. Suddenly he felt a strange sensation. He rose, forgetting his crutches, without which he had not taken a single step for eight years, knelt before the statue of Our Lady, and, rising unaided, walked three times round the Grotto. He was cured.

He was taken immediately to a neighbouring chateau. The restored limb was examined; the two wounds had closed up, leaving two scars; the broken bones had suddenly come together again.

I shall not attempt to summarize the detailed evidence for this miracle. I have said enough to induce anybody who claims to possess the slightest grain of scientific curiosity to secure, at the price of 2*d*., the pamphlet *A Modern Miracle*, in which this case is described.

In your letter of July 21st you conceded that some of the more surprising miracles at Lourdes might possibly be true, but you added that even if that truth could be established this would not prove the particular theory of their origin current at Lourdes.

Allow me to draw your attention to the following facts:

The Catholic Church alone among all institutions claims to provide a continuous record of well-attested miracles in every country and in every century since its foundation.

The application of modern methods of scientific examination has served to expose the claims of other institutions to produce supernatural cures, but has vastly strengthened the Catholic claim that God has never ceased from the foundation of the Church up to modern times to strengthen the credentials of the True Church by genuine cures of organic diseases, cures which stand the test of the severest and most exacting scientific examination.

My real difficulty is not lack of evidence in support of miracles, but lack of curiosity on the part of other people to consider that evidence. They simply do not want to be convinced, and will invent the most far-fetched explanations to escape the Catholic conclusion.

Consider, for instance, the Peter de Rudder case. You are reluctant to accept this case, if you are reluctant, because of your unwillingness to believe in any event which disturbs the continuity of nature. Our human wills are constantly modifying the continuity of nature. When I broke my leg many years ago the bones would have remained disunited had not a human surgeon set them. Is it surprising that the intrusion of God's will into the natural order should have far more astonishing results than the intrusion of human will? God can achieve instantaneously what the human surgeon can achieve over a course of months.

I have known people admit that De Rudder's bones were united instantaneously, and yet they decline to accept this miracle as evidence that the divine surgeon had been at work. They blandly insist that some unknown law has been at work, and that we know too little of the workings of nature to postulate a miracle.

All our judgments in life are based on the balance of probabilities. The God hypothesis, as you would admit, is not in itself absurd. Nor is it absurd to suppose that if God exists, he may use his will, just as we use ours, to modify what you call the continuity of nature. Catholics claim that God has promised to provide evidence in favour

of the true Church by a constant succession of signs and wonders. The De Rudder case, among other similar cases, fulfils all the conditions of the kind of sign or wonder which we should expect to take place, if Catholicism is true. Our explanation, in other words, covers the facts, and the facts themselves are a striking vindication of the promise of Christ.

If subjective faith, unassisted by any external will, such as the will of God, could produce cures such as this, it is strange that subjective faith fails so singularly in the case of Christian Science.

It is impossible to prove that A *causes* B. I cannot prove that De Rudder's bones were united because he prayed to our Lady. I can only record sequences. Indeed the complete sceptic will only admit sequence and will deny that we have any right to assume that certain things are the cause of other things. You show me a fossil series to prove that the *Equus* has changed and evolved from *Eohippus*, and you claim that *Equus* has descended from *Eohippus*. But you would be justifiably annoyed if I replied: "My dear sir, all I admit is sequence. We know too little about Nature to assume that the different varieties of *Equus* could not have been spontaneously generated from the soil. There is no proof here of descent."

God does not coerce faith, but it is difficult to imagine proofs short of absolute coercion stronger than the proofs for the miracles at Lourdes. But, as Christ said, there are people who would not be persuaded "though one rose from the dead."

I should be grateful if you would not confine yourself in your next letter to criticizing the evidence for these miracles, but would compare the evidence for (*a*) miracles at Lourdes and (*b*) the physical phenomena of the séance room with the evidence for (*c*) evolution in general and (*d*) Darwinism in particular. I am anxious to test your private evidence-meter.

If a bird evolved by descent from a reptile, this transformation took place millions of years ago. The evidence for this transformation is fragmentary and uncertain. The evidence for miracles and for ectoplasm rests on the

statements of contemporaries who can be cross-examined, and on scientific tests carried out with scientific apparatus. The credulity with which scientists swallowed Darwinism, for which there was virtually no evidence, and the scepticism with which they rejected phenomena for which there was abundant evidence, can only be explained by the pernicious influence of mental fashion.

It requires vastly more moral independence than most scientists possess to rise superior to the mental fashion of the moment. The refusal of scientists to examine psychical phenomena and the miracles at Lourdes can only be explained by the prevalence of academic snobbery. "Surely you cannot suppose," a scientist once remarked to me, "that God would manifest Himself in a small local shrine." At a meeting of the Royal Society, perhaps, after a few well-chosen words of introduction by the President. It is a pity that the God who was born in a stable, and who manifests Himself in local shrines, should have so little respect for the bourgeois prejudices of respectable scientists.

The real trouble with you people is that you have no scale of significant values. Prove to me that a table was levitated three inches by the medium Home without trickery and without contact, and you will establish a fact more revolutionary in its implications than the epoch-making theories associated with the names of Copernicus, Newton, Darwin, or Einstein. And yet Huxley, when invited to examine these phenomena, replied with a petulant, peevish refusal.

The prima facie case for these miracles is so strong that if scientists were really scientific the Royal Society would engage a special train to Lourdes.

It is only the exceptional scientist who investigates the miracles at Lourdes. And yet these miracles throw light on problems which infinitely transcend in importance the problems to which the average scientist devotes his attention. Does God exist? Does our eternal happiness depend on our conduct in this world? These are the ultimate questions. Surely a man who has devoted as much time as you have to worrying out the genetics of the primula might spare a few days to examining the miracles at Lourdes—

miracles which, if proved to be true, should revolutionize your whole attitude to this world and the next. Forget your primula for a few days, my dear Haldane, and turn your attention to the things which really matter. First things should come first.

Yours ever,
ARNOLD LUNN.

XXI.

MODERN MIRACLES EXAMINED

16 Park Village East,
London, N.W. 1.
December 13, 1933.

Dear Lunn,

I do like your quotation from Vialleton. It is news to me that he is regarded as the greatest comparative anatomist of the century. He appears, however, to be an expert on the behaviour and temperature of extinct animals, two highly speculative branches of biology. Indeed, I think his dogmatic statement about the behaviour of *Archaeopteryx* is in the same class as Mr. Pyecraft's picture of a Pro-avis. They both fall under Mr. Justice Buzfuz's dictum: "What the soldier said is not evidence." But it was a bright idea of his to dismiss *Archaeopteryx* as "a kind of abortion." I am not so clear as to what he means by calling it (and presumably *Archaeornis*) an aberrant form. They may be aberrant from his theories, but they are very close to the path of evolution from reptiles to birds postulated by other anatomists.

You ask me to criticize a passage from Macfie's book, which you quote. It is not very difficult to do so.

1. "Feathers . . . imply and necessitate correlated and adaptive changes in every part of the body." I should be interested to know what changes they necessitate in the leg-bones, the liver, and the pancreas, to mention three parts only. How do these differ from the normal in featherless birds, as they must on his theory?

2. He suggests the possibility of one reptilian scale turning into a feather, but does not believe that all could do so without design. In the first place, they didn't all so change, as a glance at a hen's leg will prove. In the second place, a slight study of genetics would have shown him that there are plenty of genes which affect all the feathers on a bird (e.g. the gene for silky feathers in poultry), while others affect only a group (e.g. the gene for crest in poultry). In such genes we have the agency which renders possible

the evolution of feathers covering most of the body, but regionally differentiated. In natural selection we have the means by which an appropriate combination of genes could be brought about. If there were a separate gene for each feather his criticism would be serious, but this is not the case.

3. "In the monstrous and anomalous bird, *Archaeopteryx*, we find feathers suddenly appearing." Poor bird, it is now a monstrous and anomalous aberrant abortion. Luckily it became extinct before learning this dreadful truth! There is of course no evidence whatever for the suddenness of the appearance of its feathers, except that no transition between feathers and scales has been found. Now such transitions are found in the case of complicated organs like the teeth of the horse or elephant, because teeth easily resist decay, whereas the vast majority of bird fossils are bones with no feathers. Clearly if anyone can prove that the feathers of *Archaeopteryx* arose in one step from scales, Darwinism will become a rather improbable hypothesis. But assertion and proof are not identical.

You twice repeat Tate Regan's joke about a species. Actually no one would hesitate to class as different species two natural forms which, like the pig and sheep, will not produce hybrids, or even those which, like the horse and ass, produce sterile hybrids. When the experiment has not been tried, or when hybridization is possible, a systematist must weigh the importance of differences in form and function. Now Müntzing crossed *Galeopsis pubescens* and *G. speciosa*, two small labiate plants which are only doubtfully different species. Among the hybrids was one with three sets of chromosomes. From this he worked up to a type with two complete sets of chromosomes from each parent species. This type was completely infertile with either parent species, but indistinguishable from a third species, *Galeopsis tetrahit*, with which it crosses readily. *G. tetrahit* cannot be crossed either with *pubescens* or *speciosa*. Of course, if, as you now tell me, Delage did not mean what he wrote, but (like the framers of the creeds) something else, all this is irrelevant to his remarks.

Now in this case the failure of the cross was doubtless due to the difference in chromosome numbers. We can

give parallel cases in many other plants. For example, the chromosome number of the tomato can be doubled by wounding it. The type so arisen crosses with ordinary tomatoes with great difficulty, and when the cross succeeds gives a sterile hybrid. I mention this case because it bears very much on Bateson's views. You have quoted a statement which he made some time before his death as to his difficulties. In justice to him I must quote further:[1]

"When such confessions are made the enemies of science see their chance. If we cannot declare here and now how species arose, they will obligingly offer us the solutions with which obscurantism is satisfied. . . . Our doubts are not as to the reality or truth of evolution, but as to the origin of *species*, a technical, almost domestic, problem. Any day that mystery may be solved."

Bateson agreed that selection could pick out varieties within a species, but did not believe that two such varieties could be produced which would give a sterile hybrid, like two species. "The production of an indubitably sterile hybrid," he wrote, "from completely fertile parents which have arisen under critical observation from a single common origin is the event for which we wait. Until this event is witnessed our knowledge of evolution is incomplete in a vital respect. . . . Meanwhile, though our faith in evolution stands unshaken, we have no acceptable account of the origin of 'species.'"

The event for which he had waited occurred about the time of his death. The case of the tomato is one example. I do not doubt that Bateson would have altered his opinion as to the origin of species when the evidence for which he asked became available, as he hoped that it might soon become.

A word as to your criticism of my theories. I have never warned you that my equations were stiffer than Einstein's! They are pretty simple. I may well have said that the complete mathematical theory would be more complicated than Einstein's theory, a very different statement. You say that I beg the question. Let us get the point clear. In your

[1] From *Evolutionary Faith and Modern Doubts*, written in 1922, and reprinted in *William Bateson, Naturalist*.

last letter you wrote of Mendel in terms of high praise. Now if his laws are obeyed certain consequences follow. You say that I begin by excluding the possibility that changes may be due to the agency of God. You can't have it both ways. If God is constantly intervening to upset Mendel's laws, then these laws are not valid, and Mendel was not the great man that you (and I) think.

You ask me why in an essay which was published in book form in 1927 I did not refer to McAtee and Uvarov. The reason is that they wrote in 1932.

You charge me with deceiving my readers, and say that I "have only succeeded in proving that white moths show up more clearly than dark on a white background." In fact Harrison (not I) made it highly probable that this fact had caused a fairly rapid change in a population, which is one step farther in the Darwinian argument. I did not confuse the reality of natural selection with the theory that natural selection helps to transform one species into another. Here is what I wrote: "To my mind the most serious argument against selection on these lines is that it does not explain the origin of interspecific sterility."[1] Fortunately this argument has become invalid since I wrote.

I like your geology. I am quite aware that you have discussed the geology of the Alps. You have no objection, I take it, to granite being thrust over sedimentary rocks to make the Jungfrau, but cannot bear the idea that the bed of the Bering Strait was once 150 feet higher than it is now, or that an overthrust should push the fossils of ancestors above those of their descendants. I wonder why.

I am interested to learn from you that I much admire Berg. I have stated the view that he wrote the best anti-Darwinian book of this century. But in my opinion it is the best of a rather poor lot. It is also useful as summarizing some quite important Russian work on crop plants which is otherwise only available in the Russian language. Berg is one of the very few biologists who believe in polyphyletic evolution, a doctrine which is becoming less and less probable in view of the extraordinary similarity which is being found in the nuclear and chemical organization of

[1] *Possible Worlds*, p. 41.

plants and animals which differ very widely in their large-scale morphology.

You say that the public are prevented from learning of unorthodox scientific views by the scientific censorship. When you show me the scientific censor I will introduce you to the Pope's wife. Actually scientists welcome nothing better than an attack on currently held scientific tenets which is based, not on abuse, ignorance, or facetiousness, but on a modicum of fact. For this reason I recommend my pupils to read Berg, and probably for the same reason Professor D'Arcy Thompson wrote a preface introducing Berg to the British public. That is how the scientific censorship works.

And, unfortunately for Berg, these missing links do keep on turning up. *Pithecanthropus* was pooh-poohed as a genus based on a single very incomplete skull. *Sinanthropus* is based on a considerable number. Since Berg wrote, a very satisfactory "missing link" between fish and four-footed animals has been found in Greenland in the shape of *Ichthyostegis*. There are lots of transitional forms between vertebrates and invertebrates, notably *Amphioxus*, but as it has no bones or shell, it is naturally enough not represented in the palaeontological record.

Next comes Mr. Dewar, whose book I read (in spite of the vigilance of the scientific censorship) some years ago. The reasons why the number of mammalian genera in the lower oligocene is greater than of those alive in Europe to-day are quite simple. The lower oligocene was laid down over a period probably to be reckoned in millions of years, and contains records of many successive faunas. The existing mammalian fauna of Europe is the record of a single moment of evolution. It is also very poor, because we had an ice age quite recently, and man has done his bit in wiping out wild types. Finally the lower oligocene, and still more the eocene, were a period of very rapid mammalian evolution, in which many new types appeared, whereas at present the tempo of mammalian evolution seems to have slowed down, while *Gastropoda* (coiled molluscs) and probably birds, seem to be evolving rapidly.

I am also prepared to believe that fossils of every existing

European land mammal have been found. Naturally so, but only a tiny fraction have been found in deposits which are likely to be turned into rocks, e.g. sand- and gravel-beds laid down by rivers. For example, many species have been found in caves. Now caves are usually found in cliffs, which are being eroded, and presumably will have disappeared, caves and all, in a few hundred thousand years.

It is a fantastic misconception that "the geological record is reasonably complete so far as fossil remains of the great types are concerned." Numbers of the most important types, including most of the phyla of worms, have no skeletons or shells, and are only inferred to have existed in the past from a few tracks and tubes, and from the general theory of evolution. Fossil jellyfish are as common as Irish snakes.

Mr. Dewar has a grouse against the Zoological Society. If I felt like that about all the journals which have rejected papers of mine I should be a bundle of nerves. I have got two papers here at the moment which have been rejected. After all, scientific editors, like other editors, cannot be expected to publish everything sent them. Nor can publishers. Among the papers of mine which have been rejected were several defending Darwinism. If I believed in the existence of a bias I could perfectly well claim that it was anti-Darwinian. It is a plain lie that men who do not accept Darwinism are deemed unfit to hold scientific offices. The council of the Royal Society[1] includes two zoologists, one being D'Arcy Thompson, who sponsored Berg's book. The other, Gray, has never to my knowledge expressed himself on evolution. The only other member of the council who has written on evolution so far as I know is Udny Yale, a statistician who some years ago published an entirely anti-Darwinian theory of evolution in the *Philosophical Transactions* of the society. I could give you plenty more examples if I thought they would weigh with you.

You end up with a definition of species by a distinguished zoologist. It is a little unfortunate for the botanist, since

[1] I refer to the list in the current Annual, enclosed herewith.

no two dandelions can be crossed, hence every dandelion on my lawn must constitute a species of one member! But, if we accept it, *Galeopsis speciosa* and *G. pubescens* are one species, which has thrown up *G. tetrahit*, a quite distinct species. Bateson's question has, as I point out, been decisively answered. If Mr. Kindersley is right, then new species have been made, at least a dozen of them. Mr. Kindersley and his audience at the Victoria Institute were doubtless unaware of the fact. And if, as editor of *The Journal of Genetics*, I reject a paper of Mr. Kindersley on the species problem, he would very likely complain of the scientific censorship.

I am glad that we have at last come to the beliefs which you say I reject without adequate examination. If you will trouble to turn to my letter of November 13th 1931 you will see that I accepted the cure of Peter de Rudder as possibly true, though I was mistaken in thinking that it occurred at Lourdes. I am quite willing to grant you that some scientists have refused to examine the evidence for spiritualism, and condemned its doctrines on *a priori* grounds. But turning to the Catholic penny catechism (pages 30, 31) I read: "The first commandment forbids all dealing with the devil and superstitious practices, such as consulting spiritualists and fortune-tellers, and trusting to charms, omens, dreams, and such-like fooleries." In other words, some scientists are as bigoted as all the Catholic archbishops and bishops of England and Wales, who approved of the above sentence. Fortunately, however, the most bigoted of scientists do not threaten others with hell-fire, and a number of first-rate scientists, such as Crookes and Rayleigh in England, have consulted spiritualists. Some were convinced by them, others were not.

Occurrences alleged to be miraculous fall, I think, into three classes:

1. Abnormal consciousness, as when A is aware of facts normally only accessible to B, where B is now alive (telepathy), dead (mediumship), or not yet born (long-range prophecy).

2. Acceleration or abnormal control of biological processes,

as when a wound heals very rapidly, or a red-hot object does not produce a blister or pain.

3. Events involving physical processes of an altogether novel kind, as when Mr. Home and his accordion were suspended in the air, or the transport from Palestine to Italy of the "holy house" of Loretto. Most of the "physical phenomena" of spiritualism belong to this type.

Having read a good deal of the literature of the miraculous, and seen a certain amount of telepathy and hypnosis, I am inclined to believe in the truth of some of the alleged miracles of the first two classes, and to doubt those of the third, though I admit at once that there is a *prima facie* case, a true bill, so to say, for them, and should not be particularly surprised if some of them were proved true. Clearly I may be over-credulous or the opposite, but as I am not a particularly good observer, I do not propose to devote myself to investigating these problems.

I should like, however, to reply to a few of your points about spiritualism. You say that the movements of objects without contact and the materialization of human forms has been proved beyond all possible doubt. Here is what Mr. Harry Price, the founder of the National Laboratory of Psychic Research, writes in *A Psychist's Case-book* (page 13): "The evidence for materializations in the séance room is weak; that for telekinesis much stronger." Mr. Price has devoted many years to investigating psychical phenomena with special apparatus, and appears to believe in psychic phenomena of the "mental" type.

The question at issue is whether mediums have produced "physical phenomena under test conditions which preclude the possibility of fraud." You admit that even the best medium may cheat. But you display a touching faith in the abilities of investigators to render fraud impossible. I don't share it. When I read in Mr. Price's book (page 75) of how Rudi Schneider, one of the mediums whom you mention, was caught cheating by a mechanical device when Mr. Price believed him to be fully controlled, I am a bit sceptical when Mr. Price still inclines to the belief that he was completely controlled on other occasions. To quote

Mr. Price (page 81): "One can hardly blame the critic for assuming that all his phenomena are suspect."

It is untrue that mediums "have beaten the greatest conjurers at their own game." Conjurers do not work in dark rooms, and specialize in evading people who believe that they are holding on to them. As Captain Maskelyne had not practised this technique, he naturally did not accept Mr. Price's offer.

You say that my reference to conjurers displays my unfamilarity with the subject. It was inspired by the fact that the late Sir Arthur Conan Doyle believed that Houdini performed his feats of escaping from handcuffs and the like with the aid of spirits. If we accept Houdini's statement that he did not use supernatural means, this shows that a quite intelligent spiritualist can be taken in by conjuring tricks.

I read the account of Mr. D. D. Home some time ago. Need you always assume that I have not heard the other side? Mr. Home may have done what is alleged. But recent psychological experiment has shown that the value of human testimony is less than was commonly thought in the nineteenth century.

However, supposing that these phenomena, and all the rest, except communication with living and active spirits of the dead (which you disbelieve) are true, what do they prove? An interesting range of physical phenomena remain for investigation, but none that you have cited seem to me incompatible with a very thoroughgoing materialism. Some eighteenth-century materialists, if I remember, believed in "animal magnetism." Dr. Tyllyard, in an article in *Nature* (July 31st 1926), which somehow got through the scientific censorship, noted a fall of temperature during supernormal phenomena, which suggests that energy which would otherwise have appeared as heat was being used to move objects at a distance. Why such a fact should be more revolutionary in its implications than the facts on which Copernicus and Newton built their theories I cannot imagine. Perhaps you will tell me.

In the same way a certain amount of leakage from one mind to another is, if anything, more surprising on the

Catholic hypothesis of a unitary soul sharply distinct from the body than on a materialistic view. For example, if the mind is a system of electromagnetic energy associated with the brain (which is one materialistic hypothesis about it) we should expect such phenomena to occur on the analogy of electromagnetic induction. We should also expect them to be unusual, as, from the standpoint of natural selection, a person who habitually experienced other people's sensations would probably be less fit than a normal person. I should not be surprised if our mental insulation turned out to be a special adaptation.

We now come to Mr. de Rudder's leg. The pamphlet is a little uncritical. Thus on page 3 we read that the fracture was "in the upper third of the leg," while on page 6 and elsewhere it is "between the foot and the knee." I put this discrepancy down to mistranslation, but in view of it I take leave to doubt some other details. Again Dr. Affenaer (page 10) said that the leg was like that of a child, not a man whose leg had been broken; but other doctors (page 17) later detected a healed fracture, which is clear enough in the photograph. However, I think the odds are that the bones were united, and the septic wounds healed, in a few hours, the most probable alternative being a pious fraud enacted by a large number of people.

The only remarkable element in the cure is its speed. Now Father Woodlock in his pamphlet on *The Miracles at Lourdes* writes: "Though we may not know all that nature can perform, we do know certainly that there are certain things that she cannot do." How does the reverend gentleman obtain this certainty about the mythical lady in question? He vouches for the truth of Bernheim's statement. "Suggestion . . . does not kill microbes or heal a gastric ulcer." Bernheim had no doubt failed to perform these feats by the aid of suggestion. But bacteria have since been killed by suggestion, or something very like it. Metalnikoff, as you probably know, claims to have been able to turn the acquisition of immunity by animals into a conditioned reflex. An animal is saved from death by a particular ritual which it has come to associate with the acquisition of immunity. In the absence of this ritual it

dies. If Metalnikoff is confirmed it will make the miracles of healing tuberculosis rather less striking. In the same way one can easily prevent the development of burns by hypnosis, as I can testify.

The idea that a limit to cell proliferation, the essential process in wound healing, is fixed by the rate of the heart beat (page 7) is quaint. In normal life the period of most rapid cell division occurs in early embryonic life before the heart has even developed! I cannot see what principles of physics, chemistry, or biology are violated if under special circumstances human tissues grow nearly as quickly as those of a rapidly growing plant.

But Father Woodlock knows a lot more about biology than I. "No discovery," he writes, "can ever upset the well-established biological laws of growth and healing." When Evans induced a group of rats to grow to gigantic size at an age when growth has normally ceased, a layman might have thought that he had upset the well-established laws governing the growth of all rats observed before that date. But perhaps Evans is a miracle worker!

Curiously enough, Father Woodlock's argument is extremely like those of the dogmatic materialists. The Jesuit says that he knows the laws of nature which forbid the occurrence of certain events, hence the events are evidences of divine power. The materialist also claims to know these laws, and deduces that the events have not occurred. As a mere investigator of these laws I cannot give unqualified assent to either of these conclusions. I think it probable that some of the events in question occurred, and call for explanation.

Now if miracles were a monopoly of the Catholic Church I think that I should have to accept your explanation. But on your own showing they are not. You believe in spiritualist miracles such as levitation. There is a good deal of evidence for Hindu miracles. Just as in De Rudder's case normal vital processes were speeded up, so it is alleged that they are slowed down in certain yogis.

Mr. Price, in the book which I have quoted (page 333) describes a Muhammadan fakir who allowed himself to be buried alive. In *Man* of 1933 (pages 1 and 44) you will find

accounts of people who walked unharmed over red-hot embers and stones in South Africa and Fiji. If Peter de Rudder proves the existence of God or the Virgin Mary, I submit that the fire-walkers prove the existence of the goddess Mariamin, a form of Kali, one of the Hindu deities who go some way towards justifying your strong views on that religion.

Now if Catholics are right, God disapproves of spiritualism and Hinduism. Hence spiritualist and Hindu miracles, which have doubtless confirmed many people's faith in those beliefs, must be due to some other agency than God, who is alleged not to deceive people deliberately. Hence it is not a ridiculous hypothesis that the cures at Lourdes are due to some agency other than God. On the contrary, it seems to me rather likely that they are due to causes of the same type as other miracles, whatever these may be. The spiritualists say that their miracles are due to spirits of the dead. You doubt this. You say that Catholic miracles are due to God, which I take leave to doubt. As to your hypothesis of "low-grade intelligences," presumably non-human, the evidence for their existence seems to me far weaker than that for God.

You talk of "the refusal of scientists to examine psychical phenomena." What does this mean? In Mr. Price's book I find the names of eleven scientists with whom I am personally acquainted who have done so, besides others whom I do not know. Most of them remained sceptical after the examination.

The reason why most scientists do not examine such phenomena is perfectly simple. To quote Mr. Price (page 11): "Ninety-nine per cent of the 'phenomena' which we hear about are due to fraud (conscious or subconscious), self-deception, natural causes, malobservation, or sheer lying." I am too busy to investigate the ninety-nine unless the one will prove to me something more than the existence of a new group of forces calling for further investigation. The same with Lourdes. I am not medically qualified, and therefore not competent to say whether a given cure is abnormal. But if I were I should probably have to spare more than the few days which you suggest before I had

the luck to see a really good cure. Only a very small proportion of the numerous visitors to Lourdes are cured. No medical institution with so small a percentage of cures could long survive.

I have never carried on some investigations on telepathy which I once began, for a different reason. The only time when I was conspicuously successful (in my own opinion) in seeing another man's mental images (for that was how I interpreted the experience) I had been very drunk the night before, and was still in an abnormal state. Another acquaintance has had the same experience. That was twenty years ago, and I do not propose to ruin my health to prove telepathy to my own satisfaction. Perhaps, as you suggest, my scale of values is wrong. I would gladly ruin my health to prove or disprove the immortality of the soul, but I cannot see that the two problems are closely connected.

You say that I should give up my genetics and "turn my attention to things which really matter." Now science has not been wholly unsuccessful in explaining remarkable phenomena in the past. Three hundred years ago it must have seemed ridiculous to people of your way of thinking that physicists did not trouble to investigate lightning flashes, but wasted their time on the tiny sparks which can be seen when amber is rubbed in a dark room. Yet the scientists were right. They devoted their attention to phenomena which could be produced with regularity and therefore readily investigated. As the result of these investigations we are able to understand, and partly control, lightning flashes, which were once regarded as obvious manifestations of divine power.

In just the same way I prefer to investigate biological phenomena which you find less striking than the cures at Lourdes. It may be that as the result of such investigations as my own a set of biological laws will be established to which such cures stand out as sharp exceptions, only to be explained by supernatural intervention. To my mind it is much more likely that these cures, perhaps after allowing for a little pious exaggeration, will turn out to be related to hypnotic phenomena as lightning flashes are to laboratory sparks.

If you can persuade me that the phenomena of which you have written really prove the existence of God or the immortality of the soul, I will of course change my views. But unless you can do so, had we not better get on to an examination of those arguments which St. Thomas, in my opinion rightly, regarded as far more important than miracles in establishing the existence of God.

You ask me why I am more ready to believe in what you call "major evolution" than in the physical phenomena of the séance room. Here is my answer. I have seen with my own eyes the appearance in plants of characters which, if found in a wild species, would lead to their assignment to a different natural order (not merely a different species) from their progenitors. I have seen the seal of specificity, so to speak, put on this evolution by the development of sterility on crossing with their ancestors. If that sort of thing can be done in five years, I think that I should be unduly sceptical if I did not believe in the probability of far more extensive changes in the course of millions of years.

I have practised spiritualism at home, and realize how easily one is deceived as to the spontaneity of movements of tables and the like. I have talked to many people who have been to spiritualist séances and have known one ex-medium extremely well. Some of them had detected fraud or come away unconvinced. Others were firm believers, and the latter shook my faith in spiritualism at least as much as the former. I merely say that good evidence for psychological phenomena is meagre and hard to come by. Whereas if you doubt my evidence for evolution I will give you the necessary plants and tell you just how to get the evidence for yourself. I will even buy you a small greenhouse in which to keep them, but you shall pay for the coke.

So now, I hope, you will answer my criticisms of St. Thomas.

Yours sincerely,
J. B. S. HALDANE.

XXII

EVOLUTIONISTS AT PLAY

Palace Hotel des Alpes,
Mürren.
February 20, 1934.

Dear Haldane,

In your defence of your passage about moths you implied that you were concerned to refute the heresies of McAtee, Uvarov, and others. You now tell me that they ventilated their odd views six years after the essay which was intended to refute them appeared. This fact seems to deprive you of any excuse for labouring to prove the truism that white moths show up more clearly against a dark background than dark moths.

Your quip about the framers of the Creed makes its second appearance in your recent letter, so I suppose I must comment on it. The framers of those creeds which you condemn as "full of obsolete science" were writing for people who understood the difference between a symbolic and a scientific statement of fact, a distinction which is expressed in the well-known maxim *Theologica symbolica non est demonstrativa.* If you referred in one of your books to the sunrise you would be surprised to be told that your books were full of obsolete science, and still more surprised if you were accused of not meaning what you said when you explained that you were well aware of the fact that the sun did not physically rise above a motionless horizon. If you wish for a pendant for the quotation from St. Thomas Aquinas and St. Jerome which I have already given you on page 52, please accept with my compliments the following quotation from Clement of Alexandria: "Form and motion, a throne, place, a right hand and a left hand, these things are not to be thought of with regard to the Father of all nor yet written of him."

"*The scientific censor.*" I never suggested that an official and organized censorship existed. I know that there is a vast field in which scientists welcome discussion. But I do contend that certain scientific doctrines, such as Evolution,

are regarded as sacrosanct, and that it is very difficult for the heretic to obtain a fair hearing. I wonder, by the way, whether any avowed anti-evolutionist has been elected a Fellow of the Royal Society during the last fifty years.

If I am wrong, I am wrong because I have been misled by eminent scientists. Auenbrugger, who discovered the percussion of the chest, claimed that envy and blame, hatred and calumny are the penalty inflicted on scientific pioneers. It was T. H. Huxley who described pedantry and jealousy as the besetting sins of scientific men, and it was Huxley himself who expressed the fear that the unofficial censorship, to which I have alluded, would prevent the publication of a paper which he describes as very original and of importance. It was Professor Hartog, another scientist, who insisted that Mivart had been ignored because he was a Catholic. It was the well-known anatomist, Professor Dwight of Harvard, who referred to that reign of terror which prevents anti-Darwinists from airing their views.

So far as scientists are concerned, this unofficial and tacit censorship seems to prevent any fair discussion of the Evolutionist arguments in scientific literature. I was an agnostic for many years, and let me tell you this: I found the case *for* atheism fully stated in the Catholic text-books of Natural Theology. I have yet to find the arguments against Evolution stated, much less refuted, in the works of leading Evolutionists.

It is, for instance, the rarest thing for the Evolutionist to draw attention to the vital distinction between what I have called Major and Minor Evolution respectively.

This annoys me not because I hold a brief for the anti-Evolutionist, but because I am genuinely anxious to discover whether Evolution has in point of fact occurred. I want the truth and nothing but the truth, and my grumble against you people is that you make it so difficult for the jury to return a true verdict. When I read the brilliant criticisms of some heretics such as Samuel Butler, Acworth or Dewar, I am desperately anxious to discover the best possible reply in defence of orthodoxy. That is why I must, with all possible sincerity of thanks, profess my great indebtedness to you for accepting my challenge. I have enjoyed few

things more than our correspondence, and I have learnt a great deal from it. I have been luckier than Butler, Acworth or Dewar, for I have persuaded at least one distinguished scientist to cross swords with me.

It is no good airily sweeping Dewar aside as a disgruntled man who is piqued because one of his papers has been refused publication. He has spent years collecting amazingly interesting statistics which have a vital bearing on a vital question, the alleged imperfection of the geological record. It was a crime not to publish his paper.

But I am not, as you seem to think, moved to protest by sympathy with Dewar's grievances. My protest is, I fear, inspired by a purely selfish grievance. The censorship of which I complain has not succeeded in suppressing the Dewars, but it has succeeded in suppressing the orthodox replies to their arguments. It is maddening to read Samuel Butler and be deprived by this censorship of all means of discovering what Darwin would have answered to his criticisms. It should not be necessary for me to engage in a public controversy with a distinguished biologist, such as yourself, to discover the reply of Evolutionists to Dewar's statistics. I was most interested in your reply, and regret that the suppression of Dewar's paper has resulted in the suppression of the rejoinder which, to some extent, renders Dewar's criticisms less deadly than they appear at first sight. I am not, you see, protesting against the suppression of the heretic, but I am protesting against the suppression of the orthodox retorts to heretical doctrines.

In view of the notorious attitude of scientists to psychical research, it is plucky of you to attempt a defence, and positively audacious of you to imply, as you do, that *Nature* has always welcomed free discussion of this dangerous subject. The real truth is that the attitude of orthodox scientists to psychical research is only now in the process of being modified under the pressure of facts. Scientists will soon find it as difficult to deny these phenomena as to deny mesmerism, the existence of meteors and other unusual phenomena which they so vigorously repudiated in the past.

"It is singular," writes Sir Oliver Lodge, "and perhaps

depressing that the obscurantist attitude of theologians in the past has been so amply imitated by the pontiffs and high priests of science in the recent present. They still oppose their admirable theories and great knowledge of the universe to resist the incursion of fresh information; they oppose observed facts on *a priori* and utterly inadequate grounds."

Once again, please note, I am subpœnaing an eminent scientist for the prosecution.

Your reference to Dr. Tyllyard's article in *Nature*, "which somehow got through the scientific censor," is an admirable example of that "tragic irony" in which the Greek tragedians delighted, the irony which consists in the use of words which have an inner meaning for the audience unsuspected by the speaker. The irony which you intended is gentle compared with the devastating irony which you achieved. For, unless my memory plays me false, the article in *Nature* to which you refer was sent to me by Sir Oliver Lodge many years ago with a covering letter in which he explained that Dr. Tyllyard's article was the first to get past that rigid censorship on psychical research on which *Nature* had insisted. Fifty years of psychical research had been completely ignored by that very conservative paper. It was not until 1926 that *Nature* condescended to admit the existence of this unclean heresy.

The difference between us is that whereas I realize that it is a human characteristic to resist new ideas, a characteristic from which neither theologians nor scientists are immune, you continue to believe in the ideal scientist of the Victorian copybook. There is something rather beautiful about the uncritical loyalty of a boy for his school or of an officer for his regiment. It is really rather jolly of you to retain your youthful illusions about scientists, and to get so pleasantly excited when you can actually prove that a scientist has admitted a mistake. It is also a little surprising.

I suppose you will admit that snow and ice are worthy themes for scientific research. Now, as it happens I have devoted many years to a systematic study of snow surfaces. My book on the subject, which has been translated into two languages, may be regarded as a modest [*sic*] contribution

to science, or as a modest contribution to science [*sic*]. Well, I have never soaped myself all over with satisfaction because I have corrected in the second edition certain mistakes in the first edition. Most people, be they theologians or scientists, admit a mistake when the mistake has been brought home to them. You will, I know, forgive me if I add that if you yourself possessed a little more of this *mea culpa* spirit you would never have tried to defend your famous passage about the moths. You would have admitted at once that it was calculated to create in the mind of the reader a confusion which did not exist in your own mind —the confusion between Natural Selection as a fact and Natural Selection as an agency for the transformation of species.

The time has come to sum up Evolution. Your cogent and attractive presentation of the case for Evolution leaves me where it found me. I am still an agnostic. I do not deny Major Evolution, but I am unconvinced that it has occurred. I have no quarrel with scientists who represent Major Evolution as a plausible theory and as a valuable working hypothesis but I resent the conspiracy which imposes Evolution on the young as a dogma which has been proved beyond all possible doubt.

"There is to-day," write Messrs. Wells and Julian Huxley, "no denial of the fact of organic evolution except on the part of manifestly ignorant and superstitious minds."

Is Sir Ambrose Fleming, F.R.S., the distinguished scientist and world-famous electrician, "superstitious" because in his recent excellent book *Evolution or Creation* he has thrown grave doubts on the Evolutionary process? Was Dr. Etheridge, the famous palaeontologist of the Natural History Museum "superstitious" when he declared in 1885 that "In all this great museum there is not a particle of evidence for the transmutation of species"? Is Dr. Fleischmann, Professor of Zoology at the University of Erlangen "superstitious" because he declared as recently as May 22nd 1933 that the modern interpretation of animal anatomy is incompatible with the leading tenets of the theory of organic Evolution?

Professor D. M. S. Watson blurted out the real truth at

the meeting of the British Association in 1929 when he said that the reason for the "universal acceptance of evolution" was that "the only alternative, 'special creation,' was clearly incredible." And, of course, being a scientist he did not think it necessary to explain why special creation was incredible.

To confuse the possible with the certain is a scientific crime, and scientific, like other crimes, are not immune from the law of retribution.

Crime begets crime. The illicit conspiracy to represent Evolution as a fact which only obscurantists could question has vitiated the scientific thought of two generations. If Evolution be certain, then scientists are justified in interpreting awkward facts in accordance with the evolutionary theory, but if Evolution be the issue in dispute, it is a scientific crime to manipulate the evidence, geological or otherwise, in the interest of an unproven dogma. But this crime is so common as to provoke no comment.

"Thus saith Evolution," and ocean beds are upheaved and strata rearranged to obey the divine command.

Scientists in their despairing search for missing links have proved themselves grateful for small mercies. A tooth or a fragment of a skull provides material for that scientific mythology which provokes the scornful mirth of those who try to obey the first law of the scientific decalogue, "Sit down before fact like a little child." It may be sound tactics for the Evolutionist to stigmatize, as Bateson stigmatizes, those who protest against these crimes as the enemies of science, for it would indeed be humiliating for the Evolutionist to concede that those who resent the confusion between the probable and the certain are briefed not by theology but by science.

"Gentlemen of the Jury, I appear for Science. Professor Haldane, the prisoner at the bar, is charged with one of the gravest crimes in the scientific calendar, the crime of making assertions which outstrip the evidence. The prisoner is a man of good education . . ."

There is no escape from the great dilemma of Evolution. Either the geological record is reasonably complete, in which

case the absence of intermediate types and missing links is fatal to the evolutionary hypothesis, or it is too fragmentary to serve as a reliable basis for the theory that the simpler forms of life appeared on the surface of earth before the complex. A single human skull in the Triassic would disprove Evolution as taught to-day, for the Evolutionist assumes that no human skulls will be found in the missing pages of Dame Nature's record for the Triassic period. But he is equally confident that those missing pages do contain the intermediate types between reptiles and birds which have so unaccountably disappeared. In other words, the Evolutionist assumes that it is perfectly reasonable for the Evolutionist but grotesquely unreasonable for the anti-Evolutionist to form definite conclusions from the absence of fossils in a given period.

And now for the Dewar statistics. First, may I register a mild protest. My reference to the completeness or incompleteness of the geological record was intended to refer to those types which have fossilized, but I dare say that some of our readers may be interested to learn that they need waste no time searching for fossilized jellyfish.

Now the Dewar statistics prove that whatever may be the case with earlier periods, mammals of the Tertiary and Quaternary periods are well represented in the geological record. The complete table, which I think I had perhaps better reproduce, is perhaps more impressive in its appearance than my brief reference to it in my last letter.

You will see that the number of fossilized land mammals does not vary very much from period to period, from age to age. In the fifteen periods which Dewar has analysed, we find an average of 102 land mammal fossils in every period. Surely it is not unreasonable to expect some record in the rocks of intermediate types during this vast period of time. Thirty-seven land mammals which were known to have existed in the Pleistocene did not exist in or before the Basal Eocene. Is it not strange that we can trace no record of the links between these thirty-seven mammals and their ancestors in these periods so comparatively rich in fossils? And yet, neither in these ages nor in the preceding ages, do we find a recognizable and coherent fragment of

the series which must be found before Evolution can be proved, a series connecting an ancestral type with a descendant of an entirely different type. This failure confirms the melancholy admission of Dacque, "Never yet has it been possible methodically and faultlessly to trace to a common origin two types or larger groups."

The number of genera of non-volant land mammals known to have lived at various stages of the Tertiary and in the Quaternary and now living in Europe and North America.

Stage	Europe	North America	Total
Basal Eocene	14	40	54
Lower Eocene	24	52	76
Middle Eocene	38	69	107
Upper Eocene	68	37	105
Lower Oligocene	80	58	138
Middle Oligocene	41	44	85
Upper Oligocene	43	57	100
Lower Miocene	52	51	103
Middle Miocene	59	35	94
Upper Miocene	81	52	133
Lower Pliocene	87	42	129
Middle Pliocene	47	18	65
Upper Pliocene	45	28	73
Pleistocene	66	84	150
Now Living	48	72	120

I am unimpressed by your airy references to Vialleton. I travelled out to Switzerland with De Beer, whose scientific work you admire, and he referred in terms of warm admiration to that very great anatomist. You yourself recommend Berg to your pupils and have spoken of him with respect in this correspondence. Does not this suggest that you would do well to modify the dogmatism with which you sweep aside as grotesque the belief shared by Vialleton and

Berg that no true intermediates have been discovered between the great phyla? You began this correspondence by reproving me for my dogmatism in accepting the multiplication table as certainly true, and asserting that I myself am something more than a "biologically convenient fiction." But the slightest hint of heresy in my verdict on the alleged reptilian ancestry of *Archaeopteryx* provoked your indignant scorn.

I am flattered that you should use the remarks which I made about Mr. Pyecraft in an attempt to apply them to Vialleton. "Vialleton," you write, "appears to be an expert on the behaviour and temperature of extinct animals." Is Vialleton to be accused of Pyecraftism merely because he says that "feathers indicate a warm-blooded animal"; your confidence that feathers have been evolved from scales can scarcely escape the same accusation, for it is surely more reasonable to deduce warm blood from feathers than feathers from scales. We have every reason to associate warm blood with feathers, but we know nothing whatever about the alleged evolution of scales into feathers. "No one knows," writes Professor Sir Arthur Thompson, "how feathers are evolved." And he adds, "There is no hint of transition between feathers and scales." Professor Ewart, again, insists that the more the history of feathers is studied, the more untenable becomes the belief in their origin from scales.

If those missing links which you tell me keep on turning up to confute Berg bear as little resemblance to the forms which they are supposed to connect as amphioxus to the vertebrates, I do not think that Berg need produce a new and revised edition just yet. The vertebrates, as Driesch remarks, "have already been 'proved' to be descended from first the amphioxus, secondly the annelids, thirdly the Sagitta type of worms, fourthly from spiders, fifthly from *Limulus*, a group of cray-fishes, and sixthly from the echinoderm larvae." I expect you know Driesch's remark, which I quote from memory, as my Mürren library is on a very small scale, that the evolutionary pedigrees remind him of the mythical pedigrees of Homeric heroes.

The geology of the Jungfrau is admittedly puzzling, for the granite is not only thrust over but actually folded into

the sedimentary rocks. The difference, however, between the Jungfrau granite and the land bridge between America and Europe is that I can see the granite from my window as I write, and I have only your word for it that this land bridge ever existed. I grant you that there is nothing in the least improbable in the existence of this particular land bridge. Equally, there is nothing improbable in the occurrence of miracles. If Evolution be true, this particular land bridge probably existed. If Christ was God, it is not unlikely that he would work miracles to provide his Church with credentials. You would, however, be very surprised if I insisted that miracles had occurred because I believed in God's existence, and you must therefore forgive me if I exhibit some surprise when the Evolutionist calmly assures me that land bridges existed because he happens to believe that Evolution is true.

The method of Science is to proceed by way of induction from proven facts to conclusions which those facts help to establish. The geologist starts from the granite on the Jungfrau and attempts to explain how the granite got there. If Evolutionists begin by assuming that Evolution is true, and proceed by way of deduction from this very dubious hypothesis to a reconstruction of prehistoric geography, they are left with nothing more substantial than the theory which they have yet to prove.

The case is admirably summed up by Arthur B. Coleman in his Presidential Address to the Geological Society of America (December 29th 1915):

"There are geologists, especially palaeontologists, who display great recklessness in rearranging land and sea. The trend of a mountain-range, or the convenience of a running bird, or a marsupial afraid to wet his feet seems sufficient warrant for hoisting up any sea bottom to connect continent with continent. A Gondwana Land arises in place of an Indian Ocean and sweeps across to South America, so that a spore-bearing plant can follow up an ice age; or an Atlantis ties New England to Old England to help out the migrations of shallow-water fauna; or a 'Lost Land of Agulhas' joins South Africa and India. It is curious to find these revolutionary suggestions made at a time when geodesists are

demonstrating that the earth's crust over large areas, and perhaps everywhere, approaches a state of isostatic equilibrium, and that isostatic compensation is probably complete at a depth of only seventy-six miles."

You must remember that Evolutionists demand a far more radical upheaval than the comparatively small uplift which is necessary to provide a bridge between America and Europe across which *Equus* passed, thereby confirming the accuracy of Isaiah's guess.

An uplift of 20,000 feet, for instance, would be necessary in parts of the Indian Ocean to bring into existence the mythical Gondwana land.

Even the most ardent Evolutionists are beginning to feel that this sort of thing has gone far enough. "Il en est," writes Beddard, "qui ne se gênent pas pour créer un continent à seule fin d'expliquer la distribution d'un genre de coléoptères." I expect you are familiar with the new series "La Paléontologie et les Grands Problèmes de la Biologie générale," under the general direction of M. Fraipont of Liège University. M. Fraipont, who refers contemptuously to the "abus flagrant des migrations," puts forward a theory of his own, which I do not find particularly conclusive, to explain the identity of the American and European horse.

The view put forward in this new series is an interesting example of those mutations of the evolutionary theory which are nearly as surprising as the mutations which have been invoked to explain Evolution itself. The early Evolutionists were once taught to believe that new types originated in a particular region and dispersed themselves over the world by migration. Rosa is the inventor of a new theory of Evolution called "Ologéenisme," according to which life appeared simultaneously over areas of the earth where generation was possible. Moreover, Rosa assures us that species have not extended their dispersion by migration, but, having once occupied the surface of the earth, have restricted the areas which they inhabit. Please do not misunderstand me. I am not defending this theory. I mention it because it is evidence of the fact that any new guess, however improbable, will be welcomed with enthusiasm in the faint hope that it may resolve the glaring anomalies

of the Evolutionary theory. I expect this new guess will go the way of its predecessors and will be quietly dropped when its inadequacy has been demonstrated. Horace Walpole, after giving a long list of the scientific dogmas of his day, which had been peacefully buried, adds, "I hold them little serious though they call themselves wisdom. How many have I lived to see established and confuted."

The Evolutionist, as I have already shown, begins with the conclusion which it is his business to prove, and then proceeds to interpret the stubborn facts of Nature in accordance with that preconceived idea.

An unbroken sequence of strata, for instance, suggests continuous deposition. The Evolutionist is often forced to deny continuous deposition because he finds in close proximity strata containing very ancient and strata containing very modern fossils, with no indication whatever of the long interval of time which, if Evolution be true, must have separated the strata in question. Deceptive "conformity," which is the technical description of the relations between two adjacent strata, has the bad taste to simulate that appearance of "conformity" which is the distinguishing characteristic of strata laid down in a period of continuous deposition. "For instance," to quote from Schuchert's *Textbook of Geology*, "in the Bear Grass quarries at Louisville, Ky., a face of limestone is exposed in which the absolute conformability of the beds can be traced for nearly a mile, and yet within 5 feet of vertical thickness is found a Middle Silurian coral bed overlain by another coral zone of Middle Devonian. The parting between these two zones is like that between any two limestone beds, but this insignificant line represents a stratigraphic hiatus the equivalent of the last third of Silurian and the first of Devonian time. But such disconformities are by no means rare, in fact are very common throughout the wide central basin area of North America."

In other words, if we accept the time scale of the fossils as proposed by the Evolutionist, we must resign ourselves to disregard the authentic evidence of those physical facts which have the bad taste to suggest conclusions which contradict the preconception of Evolutionary geology.

The Evolutionist is seldom content with what Clough somewhere calls "the mere 'It was.'" I have, I think, already quoted Mr. Chesterton's delicious passage about the *Pithecanthropus* mythology. I am glad to see that Marcelin Boule in his book *Les Hommes Fossiles* makes a very welcome protest against this sort of thing. "Such reproductions," he writes, as the *Pithecanthropus* portrait, have their place in the works of the lowest popularization. . . . Men of Science—and of conscience—know the difficulties too well to regard them as anything more than a pastime."

An excellent example of the reckless substitution of assertion for proof is your own statement that *Sinanthropus* is a missing link. If this be so, then the missing links were capable of turning out "shaped tools well above eolith level" (see page 202).

The experiments which you mention in your last letter are interesting, and certainly suggest that artificial selection is capable of producing a new species. But you will not, I hope, think me unreasonable if I suggest that these experiments, though suggestive, are but a slender basis for Evolution. Let me summarize my reasons for declaring myself an unconverted agnostic in spite of your experiments:

1. I still maintain, with Berg, that it is illicit to argue that natural selection will achieve over long periods of time what artificial selection has achieved over a short period.

2. The changes which you claim to have produced, if permanent changes, merely confirm a truth which I do not dispute, the truth of Minor Evolution. You do not prove Major Evolution by proving Minor Evolution.

3. The mutations which you have produced do not transgress the limits of the fundamental type.

4. I ask in all humility is there any definite evidence that the changes which you have produced are not the result of any combinations of genes previously in the chromosomes or of the loss of original chromosomes?

5. Are you confident that your experiments would lead Bateson to revise the verdict expressed in the following passage? "Analysis has revealed hosts of transferable characters. Their combinations suffice to supply in abundance series of types which might pass for new species and

certainly would be so classed if they were met with in nature. Yet, critically tested, we find that they are not distinct species and we have no reason to suppose that any accumulation of characters of the same order would culminate in the production of distinct species."

In conclusion let me sum up. Evolution, as we have seen, is *de fide* for the atheist, but an open question for the Christian. We do not need to disprove Evolution to disprove or to discredit atheism, but it is clear that atheism could not survive the refutation of Evolution. The chief importance, however, of the evolutionary controversy is its value as an evidence meter. Those who assert that Evolution has been proved beyond all reasonable doubt are guilty of a sin against science, the sin of confusing the possible with the certain. Those who accept Evolution and reject the supernatural are self-convicted of selecting their beliefs not in accordance with an objective scale of evidence but in accordance with a purely personal and private prejudice.

A critic, for instance, who accepts Evolution as an article of faith but who contemptuously rejects the evidence for the miracles at Lourdes or well-established psychical phenomena chooses his beliefs to suit his mental complexion just as a lady chooses a hat. I readily concede, however, that you are more open-minded on the subject of Lourdes than I had expected. I owe you an apology for forgetting your previous reference to De Rudder. It was wrong to imply that your mind was firmly closed to the possibility that miraculous cures occurred at Lourdes. You do not rule out, as Huxley ruled out, the phenomena of the séance room or the miracles at Lourdes as too grotesque to deserve examination. Your readiness to admit the possibility of such supernormal phenomena is an interesting indication of the distance which we have travelled since Huxley's day. You admit the possibility that these miracles occur; twenty years hence scientists may be prepared to accept the Catholic explanation of these miracles.

Your remarks about psychical research call for some comment. I cannot follow your allusion to Mr. Price. Surely the scrupulous fairness with which he records every

incident which seems to tell against the genuineness of these phenomena is evidence of his impartiality, and should incline one to accept his verdict on the residuum of phenomena which he regards as genuine. He has, as you will admit, developed a marvellous scientific technique for detecting movements, conscious or unconscious, on the part of the medium, a technique which includes the ingenious use of infra-red rays.

I am sorry you did not comment on the paraffin glove, which I personally regard as by far the most potent evidence in support of the supernormal phenomena.

Now for conjurers. You say that conjurers do not work in the dark or specialize in avoiding people who believe that they are holding on to them. Now, in the first place, many of the most remarkable psychical phenomena have been reproduced in a good red light, and some, such as Home's, in broad daylight. In the second place, conjurers *do* specialize in attempting to avoid the control of those well-meaning members of the audience whom they invite from time to time on to the platform "to see fair play."

The vital fact is surely this. No conjurer has yet produced under test conditions as severe as those to which mediums submit phenomena specified by Mr. Price in his challenge to Captain Maskelyne. No conjurer has ever produced a paraffin shell similar to those produced by the French Metapsychic Institute. You mention Houdini. Now Houdini was perhaps the greatest conjurer who has ever lived, and was a conjurer who had made a special study of mediumistic phenomena. He was on the committee appointed by the "Scientific Americans" to investigate the "Marjorie" phenomena. On two celebrated occasions he was detected cheating against "Marjorie" in an attempt to stage an exposure.[1]

Houdini never duplicated the paraffin shell glove or submitted to the more severe conditions under which psychical phenomena have been produced. I know that Sir Arthur Conan Doyle believed that Houdini was a medium, but I do not quite see what bearing Sir Arthur's views have on this particular question. Sir Arthur, one of the most

[1] See *The Flight from Reason*, page 210.

generous-hearted men that ever lived, was not conspicuous for scepticism or judgment in psychical research.

There is keen competition among conjurers, and there would be big money in some of these medium tricks, if they are tricks. A conjurer who could produce these paraffin shell gloves under test conditions would outdistance all rivals. You say that Captain Maskelyne has not practised this technique. Why has he not practised it? Why has he not succeeded where mediums, some of whom have been people of very low intelligence, have succeeded, mediums who have never been known to practise the simplest tricks of legerdemain much less pass through a severe technical training to which all good conjurers submit?

Now for the miracles at Lourdes. Your attitude on the subject of De Rudder encourages me to invite your verdict on a miracle for which the evidence is even stronger, if that were possible, than for the De Rudder miracle.

Marie Lemarchand. An interesting case of advanced lupus was that of Marie Lemarchand. Zola describes her as he saw her when on her way to Lourdes. He says: "It was a case of lupus which had preyed upon the unhappy woman's nose and mouth. Ulceration had spread and was hourly spreading and devouring the membrane in its progress. The cartilage of the nose was almost eaten away, the mouth was drawn all on one side by the swollen condition of the upper lip. The whole was a frightfully distorted mass of matter and oozing blood!" All this is true as far as it goes, but the account given by Zola was incomplete. She had been coughing and spitting blood and every evening there was a high temperature. The apices of both lungs were affected and she had sores on her leg and other parts of her body.

Dr. d'Hombres saw the patient *immediately* before and *immediately* after her bath. He says: "I saw her waiting her turn to go into the piscina. I could not help being struck by her aspect, which was particularly revolting; both her cheeks, the lower part of her nose, and her upper lip were covered with a tuberculous ulcer and secreted matter abundantly. On her return from the baths I immediately followed her to the hospital. I recognized her quite well although her face was entirely changed. Instead of the horrible sore

I had so lately seen, the surface was red, it is true, but dry and covered with a new skin. The other sores had also dried up in the piscina." Dr. d'Hombres at once took Marie Lemarchand to the medical office, which was full of doctors, literary men and reporters. The doctors could find nothing the matter with her lungs and they testified to the presence of the new skin on her face. Zola was there. He had said before, "I only want to see a cut finger dipped in water and come out healed." "Behold the case of your dreams, M. Zola!" said the President, presenting the girl, whose hideous disease had evidently made such an impression on the novelist before the cure: "the visible sore, suddenly healed." "Ah, no!" said Zola, "I do not want to look at her. She is still too ugly"—alluding to the red colour of the new skin. Before he left Lourdes, Zola had hardened his soul. "Were I to see all the sick at Lourdes cured, I would not believe in a miracle," he said to Dr. Boissarie, the President of the Bureau.

I claim that if we reject the evidence for this miracle, we must inevitably submit that it is impossible to arrive at any valid conclusion based on human testimony.

So much for the facts. Now for your attempt to explain away those facts. I regard a miracle, as I have already stated in an earlier letter, not as a violation of the laws of Nature but as a modification by a superhuman will of the effects which would normally be produced by natural law. I thought I had made this clear in an earlier letter, but I was wrong. For your reference to Mendel shows that you have yet to discover that there is nothing inconsistent in studying natural law, as Mendel did, and accepting, as Mendel accepted, that those laws can be modified from time to time by superhuman, and by human, wills. "If God is constantly intervening," you write, "to upset Mendel's laws, those laws are not valid, and Mendel was not the great man that you (and I) think." This reminds me of the sort of people who talk about Euclid being out of date. Euclid's theorems are as true to-day as they ever were, for Euclidean space which was the only kind of space with which Euclid was concerned. The laws of Mendel are true in the conditions with which Mendel was concerned. But Mendel

himself would have been the first to admit that it is impossible to explain Evolution, if Evolution on a great scale has indeed occurred, without invoking the hypothesis of a superhuman will modifying from time to time the natural effects of natural law.

Your reference to Mendel reminds me of Bishop Barnes's remark that if miracles at Lourdes occur rational medicine is impossible. On which I may perhaps be allowed to quote Father Knox's comment, "If Bishop Barnes had been present at the feeding of the five thousand, he would have said, 'This is the end of all rational bakery.' "

You yourself claim to have been responsible for the appearance of a new species which was the result of experiments in which human will modified the effects which would otherwise have been produced by natural law, Mendel's laws among others. You will forgive a superstitious Catholic if he finds it as easy to believe that God could create a new genus as that Haldane could create a new species.

Miracles have been defined in various ways. A useful definition which both you and I could accept is the definition which I have found in the Oxford Dictionary. According to this dictionary a miracle is "a marvellous event due to supernatural agency."

It is clear that within the limits of this book we can only profitably discuss the issue between the theists and the atheists, between those who believe in the spirit world and those who do not. It would therefore be beside the point to discuss whether the miracles at Lourdes are, or are not, evidence of the particular truths of Catholicism. They certainly provide irrefutable evidence in support of the existence of a spirit world. Similarly you will not expect me to discuss whether a particular miracle, such as the Hindoo miracles which you name, are the work of evil or of good spirits. The only case which I am trying to establish in this book is that spirits both good and bad exist, and from time to time modify the effects of natural law.

While we are on this subject you may perhaps be able to explain why it should still be considered a sign of enlightenment to reject with contemptuous disdain the possibility that evil spirits may exist. In that very unenlightened age,

the post-Darwinian period, a familiar argument against the deity of Christ, an argument which betrays its origin by begging the question at issue, was as follows. Christ believed in evil spirits. No intelligent person believes in evil spirits. Therefore Christ could not have been God. Even to-day there are Christians who are so infected by the snobbery of the intelligentsia that though they are prepared to believe in the existence of good spirits, they are not prepared to believe, as Christ believed, in the existence of a personal tempter and in the existence of evil spirits. Here, as in other matters, it is the Modernist whose judgments are influenced by fashion and by emotion, and the orthodox Christian who is the true scientist. If there be a single valid *a priori* argument against the possibility that evil spirits may exist, I have yet to hear it. This is a question which can be decided by evidence alone, and the verdict could not be in doubt. Every age and every country has contributed to the stream of evidence for the existence of a spirit world. I have just been reading an account of a comparatively recent case of diabolical possession in Alsace. I was most amused by the desperate straits to which people of your school of thought are reduced in their efforts to explain away these facts.

And this would seem to be the proper place to correct your odd misunderstanding of most of the Penny Catechism. Even if you reject the evidence for the existence of evil spirits and for the possibility that spiritualism may have dangerous results, you will, I suppose, agree that nobody is likely to receive much useful information from "Great Hawk," "Feda," or any other alleged control. If so, you must concede that it is a hideous waste of time to "consult" "Great Hawk" or "Feda." If you admit this, you can hardly grumble because the Church forbids its children to "waste time on such like fooleries." You secularists are hard to please. I really should have thought that for once the Catholic Church and you would be in hearty agreement. For please note that the Church does not forbid scientific investigation of these phenomena. You have not taken the trouble to examine the Catholic document with sufficient care, and have failed to realize that the operative words in

your quotation from the Penny Catechism are "consulting" and "trusting." The Church forbids "all dealing with the devil, superstitious practices such as consulting spirits and fortune tellers, and trusting to charms, omens, dreams and such like fooleries." A Catholic who could convince his Bishop that he possessed the necessary qualifications for investigating these phenomena, that he was inspired solely by scientific curiosity, would have no great difficulty in obtaining the necessary permission. The Church which stands for sane supernaturalism which can be justified by reason, has always been the foe of irrational superstition. The decay of institutional religion is always followed by a recrudescence of superstition. This was the case in ancient Rome; it is the case in modern London. The results of fifty years of intensive propaganda by the Rationalists is a growing distrust of reason and a vast increase in the number of those who consult mediums and fortune-tellers. The sort of people who refer contemptuously to Catholic superstition may be observed chasing round the bridge-table in search of lucky seats, and adorning their persons and their cars with charms, mascots "and such like fooleries."

To sum up: here is for your acceptance a single hypothesis which explains all miracles, the hypothesis that the spirit world exists, that miracles are produced through the agency of spirits, some of whom are good and some of whom are bad.

This hypothesis explains not only the miracles at Lourdes, but the miracles of spiritualism. These may be due to evil spirits, or to low-grade intelligences.

If we reject this single explanation, which covers all the facts, we are reduced to a series of miserable subterfuges. We have to explain one miracle by fraud, another by hallucination, another by malobservation, and finally we are reduced, as you are, to invoking psychology, that sure refuge for troubled atheists, in an attempt to discredit all human testimony. The flight from the supernatural in this, as in all else, involves a flight from reason, a flight which ends in complete scepticism of the power of human reason to arrive at a valid conclusion.

Entia non sunt multiplicanda sine ratione. The supernaturalist need not multiply explanations without reason. The single explanation, mentioned above, covers all the facts.

I am amused by your plucky determination not to admit the possibility that J. B. S. is not the crown of spiritual creation, and I can only attribute this queer inhibition to the paralysing effect of those queer old Victorian prejudices against the supernatural which still survive. You, at least, may congratulate yourself on having made substantial progress along the road to truth. You are prepared to concede the possibility that certain supernormal happenings have taken place, provided that we do not ask you to accept the obvious explanation of those facts. You are indeed the successor to those Pharisees who accepted the miracles of Christ but rejected the great fact which those miracles proved. The Pharisees attributed these miracles to Beelzebub, for they were rational enough to realize that miracles must be due to good spirits or to bad spirits, in which they were more scientific than most of our modern scientists. You, less logical than the Pharisees, pathetically invoke laws which have yet to be discovered, and, like Micawber, continue to hope that something will turn up to confirm your wistful belief in the possibility of explaining miracles without invoking the hypothesis of a spirit world.

"How can the assumption," writes Mr. Grant, "of unknown laws or of unknown natural causes be better *science* than the determination to abide by recognized, fundamental, so to say necessary and obvious laws, to abide by careful observation and by enlightened failure? The 'rationalist' who denies the reality of, for instance, all well-attested cures at Lourdes (cures of organic diseases) is a fool; but what shall we call the man who assumes, and keeps on assuming even after careful study, that they are natural events? A visionary, I think; a man who has run to death his original inspiration.'"

This quotation is taken from a strange and stimulating book, *A New Argument for God and Survival* by Malcolm Grant (Faber and Faber). Mr. Grant is not a Christian, and I violently disagree with his theories about God. But

his book is worth reading for the masterly survey of the evidence for the occult, and for the stimulating criticism of the attitude of conventional scientists towards the occult.

I realize that if you persist in basing your case on laws which have yet to be discovered, all argument between us should logically come to an end. But this obstinate refusal to draw the obvious conclusions from patent facts can be employed with equal effect to deny the genetic link between, say, the ammonites in the lower and upper strata of a limestone cliff. If I were to assert that each new variation of the ammonites was blotted out completely by God, and that a slightly different variation was newly created to take its place, your only reply could be that it is impossible to believe in so irrational a deity. But my theory would fit the facts just as well as yours.

It would, indeed, be just as impossible to find a final argument against a captious sceptic who denied any genetic connexion between closely allied species, as to convince you of the causal connexion between miracles and the spirit world.

In fact, if you persist in appealing to unknown scientific laws, I cannot refute you, for the man who draws blank cheques on the future must be in an impregnable controversial position. Perhaps an illustration, which I have already used elsewhere, may help to bring home to you the fundamental weakness of your case. Among the phagocytes which inhabit my body there are some which are rational and others which are influenced by the mental fashion of the day, and who accordingly find it difficult to accept any belief which makes the slightest strain on their imaginations. Some, whom we will call Lunnists, believe that the Lunniverse in which they live is controlled by a mind. The others are firmly convinced that only superstitious phagocytes could possibly believe that the phagocyte does not represent the highest form of intelligence in the vast Lunniverse.

One day an operation for appendicitis is performed on the person of the said Lunn. The heavens open, a flash of steel is seen, and Appendix Island disappears. Thousands of phagocytes in the neighbourhood are destroyed, and the survivors triumphantly proclaim this miracle as evidence

of the fact that the Lunniverse is not a closed system, and that from time to time the normal effects of natural law are modified by a higher intelligence. But the Alunnists are unshaken in their belief that Lunn is a figment, and nothing disturbs their serene conviction that they represent the crown of creation. They accept with reluctance the facts of the sudden opening of the heavens and the disappearance of Appendix Island, but they express their unshaken confidence that these facts will some day be explicable in terms of a scientific law which will one day be discovered.

Perhaps in your next letter you will explain why you find it so difficult to believe in the existence of spirits more intelligent than J. B. S., and whether you can justify this disbelief by anything which can be dignified by the name of evidence.

Yours ever,
ARNOLD LUNN.

XXIII.

MORE "SCIENTIFIC INTOLERANCE"

16 Park Village East,
London, N.W.1.
April 19, 1934.

Dear Lunn,

Seven months ago I wrote to you about the alleged proofs of the existence of God. But I have not yet elicited a reply. As I am interested to know on what rational grounds you hold this hypothesis, I shall try to be as brief as possible concerning the numerous red herrings which you drag across the trail.

Thank you for your quotation from Clement of Alexandria, with which I am in full agreement. Clement wrote about A.D. 200. To-day the official creed of large sections of the Christian Church contains the phrase "and sitteth at the right hand of the Father, from whence he shall come to judge the quick and the dead." I entirely agree with Clement that such phrases should not be thought of or written down. But only seventeen centuries have elapsed since he wrote, and the Church has not yet acted on his opinion by deleting such phrases from its creeds.

In your next paragraph you ask for the name of an avowed anti-evolutionist elected to the Royal Society during the last fifty years. Thank you for supplying me with the answer a few pages farther on. Sir Ambrose Fleming, on your own account, is one such. You can't eat your cake and have it. If "a reign of terror prevents anti-Darwinists from airing their views" how comes it that the various anti-Darwinists whom you quote have attained to professional chairs and other scientific posts? I suggest that in your future writings on this subject you should support one of two theses. Either (*a*) a number of men of unquestioned scientific eminence do not believe in Darwinism, or (*b*) a reign of terror prevents any anti-Darwinists from being appointed to high positions in the scientific world.

But to prove both points at once would have taxed the logical powers even of St. Thomas. The fact is that very

few competent scientists disbelieve in evolution. A few do so, but this does not interfere with their careers, any more than does a belief in the views of Mrs. Eddy, Major Douglas, or the Pope, provided they are considered to be competent at their particular jobs.

Your quotation from my colleague Professor Watson is at first sight devastating. But as you have read Mr. Drawbridge's book on the religious beliefs of scientists it is curious that you did not notice that Watson's answer to the question "Is it your opinion that belief in evolution is compatible with belief in a creator?" was "Why not?" A typical example of hide-bound scientific dogmatism. Now Watson has devoted most of his life to palaeontology, and believes that the only alternative to evolution is "special creation." He rejects your theory of "major" and "minor" evolution. Most people who have studied the evidence find it incredible that the existing species, e.g. horse, ass, zebra, quagga, were created as such. This is what is meant by the doctrine of special creation. If you had devoted most of even one year to examining the evidence for evolution by actual dissections, handling fossils, and so on, I think you would find the doctrine of special creation (which you do not hold) even less probable than you do at present. I should find it much easier to argue with you if you had a first-hand acquaintance with the facts of comparative anatomy, as you have in the case of geology, and knew its terminology.

Since you still trot out Dewar's argument that the geological record is nearly complete I may as well deal with it. The simplest way to find out whether a stock is nearing exhaustion, if you cannot get a direct estimate of the remainder, is to see how quickly it is being drawn on. For example, if you tell me that almost all the available gold in the world has been mined, I point to the statistics of gold output. The number of new fossil non-volant mammalian genera listed in the *Zoological Record* for 1932 was 60, with 7 sub-genera (I do not know if Dewar would include these). Does that suggest exhaustion? The total number of new mammalian genera and sub-genera for 1932 was 74, i.e. all but 7 were fossil non-volant land mammals. The corresponding numbers from 1925 onwards are 41, 59,

49, 78, 71, 57, 51. Before that year they are not recorded. You see that there is no evidence of the supply running short.

Let us look at Dewar's figures in another way. He lists 1,412 fossil genera spread over a time estimated at 50-60 million years. The average length of the 15 periods into which he divides it is thus between 3 and 4 million years. Such a period is a very long time. It is entirely ridiculous to compare a space of 3 million years with a single instant. There has been time within that period for forms different enough to be put in different genera to succeed one another repeatedly. If a fair comparison is to be made between the existing animals and those of a past age, each of Dewar's periods would have to be split up into about a thousand sub-periods of three or four thousand years each, i.e. as long as human history. You would find remarkably few fossil animals in any one of them. I should have thought you would have seen through the trick of dividing the Tertiary group into the particular number of series which suits a given theory.

I fear that I find your remarks which follow Dewar's table unintelligible. You say that "Thirty-seven land mammals which were known to have existed in the Pleistocene did not exist in or before the Basal Eocene." As no species of land mammals found in the Pleistocene existed (or, to be accurate, left fossil records) in the Eocene, this is not surprising. If you mean that of the hundreds of Pleistocene species thirty-seven cannot be traced back very definitely, I do not wonder. I should have put the number higher. But in view of the rate at which new fossil mammals are being found, I have good reason to suppose that many of their ancestries will be traced.

I cannot see the relevance to your argument of Rosa's "Ologenese," which fell rather flat, as it is contradicted by the evidence from geology and geographical distribution. As for Vialleton, you have not told me who regards him as the greatest comparative anatomist of the century. Dr. de Beer tells me that he considers his text-book very useful, but you will surely agree that the writing of a good text-book does not make one a great scientist. What are his other claims to fame?

Your comments on my defence of evolution are interesting. You write that I "implied" that I was refuting Uvarov when writing six years before he did. Would it not be more correct to say that you misunderstood me? It was, as you say, "calculated to create in the mind of the reader a confusion," but only if he had not read the rest of the article. But may I make my point clear? Because more white moths than black are killed by owls it does not follow that their numbers will diminish. They might well obtain a more than compensating advantage from the fact that (in this particular species) they lay their eggs later. Hence it was worth showing that they had increased, and those who were sceptical of the value of protective coloration were not so stupid as you suppose.

You say that I "sweep aside as grotesque the belief . . . that no true intermediates have been discovered between the great phyla." Be so good as to quote my remarks on this topic, or to withdraw this statement. I have never expressed any confidence that feathers were evolved from scales. Nor is my belief that the Bering Strait may have been dry when trees grew on the Dogger Bank countered by remarks on the stability of the Indian Ocean. You "maintain, with Berg, that it is illicit to argue that natural selection will achieve over long periods of time what artificial selection has achieved over a short period." Now Fisher, Wright, and I all claim to have proved this by mathematical arguments published after Berg wrote. Rather than attempt to refute these arguments you shelter yourself behind the authority of a man who had not read them. This is an excellent example of "The Flight from Reason" on which you are an expert.

But your best effort is your comment on the experiments of my colleagues at Merton (not my own). (I did not give my colleagues' names as I did not wish to expose them to your abuse.) I make certain claims about them, to which you remark: "The mutations which you have produced do not transgress the limits of the fundamental type." I do wish I possessed your certainty about the results of other people's experiments. I am at the moment, for example, continuing on a slightly extended scale an experiment by

a colleague which purports to prove Lamarckianism in rats. If only, like you, I could say to their author, "Your experiments do not show any inheritance of acquired characters," I should be saved a lot of trouble. Will you tell me whether you arrive at the truth about other people's unpublished work by reason, or by revelation? In view of your special knowledge I need not answer your other questions, except to say that I think Bateson would have revised his opinion in view of the subsequent work of Chittenden, Clausen, Goodspeed, Brieger, Newton, Pellew, Skovsted, Müntzing, Darlington, Buxton, Sveshnikova, Blair, Watkins, Huskins, Karpechenko, and Harland, to mention a few names taken at random. Lastly I would add that I have not, as you write, stated the case for evolution. That would take a book. I have merely dealt with your objections to it.

You now proceed to attack the management of two scientific journals, *Nature*, and the *Proceedings of the Zoological Society*. "Unless my memory plays me false," you write, Sir Oliver Lodge informed you that "Dr. Tyllyard's article was the first to get past that rigid censorship on psychical research on which *Nature* had insisted." You proceed as follows: "Fifty years of psychical research had been ignored by that very conservative paper. It was not till 1926 that *Nature* condescended to admit the existence of this unclean heresy."

Well, your memory does play you false, or alternatively Sir Oliver is not as trustworthy a witness as many spiritualists believe. In the year 1924 *Nature* published a summary of the annual address of the President of the Society for Psychical Research, and a quite sympathetic review of Lord Dunraven's book on D. D. Home, besides a leading article on spiritual healing. Further comment on your statement appears to be superfluous.

It was a crime, apparently, for the Zoological Society not to publish Dewar's paper. Perhaps you do not realize that its "Proceedings" are mainly devoted to living animals. It occasionally publishes an account of a fossil species. But it is an entirely unsuitable journal for a critical review of palaeontological ideas. Such reviews are published in journals of a different type, such as "Biological Reviews." It

does not reject articles because they attack Darwinism; for example it recently published one by Dunkerley contending that natural selection could not account for the evolution of various worms. But like every other journal, from the *Girl's Friend* to the *Mathematical Gazette*, it rejects articles outside its usual field, unless they are regarded as particularly good. It would probably reject an article by me on the mathematical theory of evolution. Several other journals did. But only a person who had no experience of scientific publications would regard this as a crime.

Actually it appears to have been rejected because, probably for the reasons which I have given, among others, it was thought to be entirely inconclusive. Please let me know whether, as an editor, I ought to publish papers which I deem inconclusive, and if so where I am to get the money to do it.

I wish you anti-scientific people would take the trouble to read scientific journals, in which almost all new contributions to science are published. It would save you a lot of mistakes. For example, in the *Animals' Defender and Zoophilist* for March 1934 I read that I am "one of the chief contributors to the *Journal of Physiology*, that dreary record of interminable, futile and heartless vivisections." I have not contributed to it since 1928, and as the vivisections which I recorded in it were all of myself and two colleagues they may have been futile but were probably not heartless. But if you actually took to reading scientific periodicals you might come to understand the sort of evidence on which science is based. And that would never do.

I did not refer to paraffin gloves because the cholesterol experiment which you quote merely shows that they were made from wax prepared by the investigator, and not that they were made supernaturally. Conjurers have to earn a living, and I doubt if Captain Maskelyne, even if he "outdistanced all his rivals," would make as much money by producing paraffin gloves in a darkened room, as he does by doing very remarkable tricks on a lighted stage. Did the conjurer Davey, who as reported in Vol. IV of the *Proceedings of the Society of Psychical Research*, was able to duplicate certain "occult" phenomena, so that some of

his audience credited him with supernormal powers, make a good thing out of it financially? If not your case collapses.

I am delighted to get your own attitude to spiritualism. You say that I will agree that no one is likely to get useful information from the spirits which control or are alleged to control mediums. And therefore you think I should be in favour of forbidding people to consult mediums. Unfortunately we differ in our views about liberty. I think sane adults should be allowed to do all sorts of things from which, in my opinion, they are unlikely to gain much benefit, for example going to dog-races or Catholic services. One reason for holding this view is that I realize that many activities now regarded as praiseworthy have at one time been forbidden. Hence although I think spiritualism is probably false, I realize that it may contain some truth, which may emerge in time. For this reason I have a more open mind than the bishops. One of the best ways to ascertain this truth is clearly to consult a medium. You tell me, by the way, that rationalism is largely responsible for the growth of superstition. "The sort of people who refer contemptuously to Catholic superstition," you write, "may be observed chasing round the bridge-table in search of lucky seats, adorning their persons and their cars with charms, mascots, and such like fooleries." How right you are!

Here is a quotation from the *Daily Telegraph* of March 17th 1934, describing a great lottery under State auspices: "The counterfoils, in boxes labelled 'soot,' were carried in a carnival procession through the streets, contrived to emphasize the general theme of 'good luck' associated with the sweep this year. A huge model of a black cat, 14 ft. long, with its head nodding and tail wagging, led the procession. In the Plaza itself symbols of good and bad luck are everywhere—ladders, broken mirrors, sweeps and brooms."

This was in Dublin, which, as you know, has for some years been ruled by a gang of militant atheists, and look what comes of it.

I don't find Marie Lemarchand so impressive as Peter de Rudder. Zola's account is, I think, taken from a novel, a fact not stressed by the Catholic Truth Society. But he

only described what he saw. The pamphlet describes the condition of her lungs. If you had spent a few months in hospital wards and occasionally attended a post mortem you would realize that this was probably a deduction from percussion, and that such deductions are not infallible. The facts actually visible, if we are to trust Dr. d'Hombres, are that her face was oozing before she went to the baths and dry when she came back. This seems to me a fact of the same order of miraculosity as the failure of a red-hot cigarette to raise a blister under hypnosis. It is, I think, explicable by an abnormal activity of the vaso-motor nerves, which can influence the permeability of the blood-vessels. There are so many facts of ordinary physiology of which no complete explanation has yet been given that one more is not likely to convert me to any religion, unless it is a violation of those laws which apply to all physiological phenomena investigated in the laboratory, such as the laws of the conservation of energy. I cannot appreciate the distinction which you draw between the violation of a law and the modification of the effects which would normally be produced by it. Please tell me by what criterion they may be distinguished. A scientific law is not a cause producing an effect; it is a statement of the fact that a member of the class of events A is followed or accompanied by a member of the class of events B. You say that I (or some other human being) have modified the effects which would otherwise have been produced by Mendel's laws. Maybe. But I did so by making use of those laws, which were not, as you say, modified, just as I make use of the law of gravitation by resting my paper, which would otherwise fall to the ground, as I write.

You say that miracles such as the rapid healing of tuberculous ulcers provide irrefutable evidence of the existence of a spirit world, but you do not tell me how. If these events occur that is one explanation of them, as natural selection is one possible explanation of evolution, supposing it to have occurred. But there is plenty of other evidence for natural selection as a fact, and very little direct evidence for the existence of disembodied spirits. They may exist, just as free magnetic poles may exist. But neither has yet

been found (in my opinion) except in association with a particular material structure.

You ask why it is considered a sign of enlightenment to reject the possibility that evil (disembodied) spirits may exist. I will tell you. If they exist and have dealings with men with consequences as dreadful as you believe, the Church had (in my view) a very good case for burning thousands of witches alive after appalling tortures. But I am so steeped in Victorian liberalism as to regard this as an unenlightened procedure. You regard the miracles of other religions than your own, e.g. spiritualism and Hinduism, as probably due to evil or at best low-grade spirits; and if this is so it would be right to treat their adherents as the Christians treated witches. I happen to have some spiritualist and Hindu acquaintances, and question whether it would be really enlightened to execute them, even by a painless method.

But I quite agree with you that if there are good disembodied spirits there are probably evil ones, and that it is illogical, without better reasons than exist, to believe in the one and not the other.

My objections to your single hypothesis to explain all miracles are quite simple. You say that they are produced by the agency of spirits, some good, some bad. (Here, by the way, you disagree with St. Thomas, who in the *Summa Theologica* Pt. I, Quaestio CX, Article 5, discusses the question "whether angels can work miracles," and answers it in the negative.)

Now, firstly, this hypothesis can be used to explain any phenomena you like. The motions of the stars were at one time explained as due to spirits guiding them.[1] It was a complete explanation, but unscientific because it could not be tested. These motions have since been explained by gravitation plus a series of "miserable subterfuges," such as light pressure in the case of comets, the Friedmann-Lemaître effect for distant nebulae, and so on.

Secondly, the historical argument appeals to me. In primitive societies such as those of West and Central Africa, all phenomena not understood, e.g. all non-violent deaths,

[1] See *St. Thomas, passim.*

are put down to the activity of spirits. As knowledge increases more and more of them are explained in other ways. There are now rather few left over in which the intervention of spirits is in the least plausible. A hundred years ago the best we could do to cope with an epidemic of cholera was to say prayers, and thus obtain aid from the spiritual world. It has since been discovered that the cause of cholera is to be found in the material world, and is readily destroyed by boiling. I am sufficiently impressed by the history of science to suppose that this sort of thing will go on. Now I quite grant you that the good old miracles of the past, if true, involved a very considerable interference with ordinary laws. If the sun and moon stood still to enable Joshua to kill more Gentiles, if the holy house was carried from Palestine to Italy by angels, and so on, then clearly some superhuman power is at work. But if we accept your physical phenomena, what do they amount to? Objects are moved at a distance in the neighbourhood of an entranced medium. Crockery is smashed and oil drips about in a house where there is an unhappy child. Before I accept the theory that these things are due to disembodied spirits, for the existence of which there is little other evidence, I think one should test not only the hypothesis of fraud but the hypothesis that people in certain abnormal conditions can move objects without touching them, as a magnet can. Many of the alleged facts suggest this sort of thing. Why should a disembodied spirit generally refuse to move objects in a lighted room? Why should it (in modern miracles) dispose of no more energy than is available from human sources?

Your spirit theory has in all ages been the favourite refuge of ignorance. I am only surprised that you do not employ it more widely. Are you quite sure that Sir John Reith is not a mighty enchanter, with power over many fairies, who do his bidding and carry his messages through the world? Is it anything but the prevailing fashion which makes you reject this simple hypothesis in favour of an elaborate theory of waves which (as is admitted on all hands) are invisible, in a probably imaginary medium called the ether. After all, until the present wave of materialism

swept the world, almost everyone would have held this simple theory. It is true that I don't know why these fairies should like certain apparatus, but then I don't know why the spirits at seances should object to strong light.

To conclude, I do not in the least find it difficult to believe in spirits more intelligent than myself. In fact I know several. But all are connected with human bodies. As my intelligence is a function of my body, diminishing when I am ill or drunk, I am waiting for evidence of the existence of other spirits which are not conditioned in this way. All you have so far given me is a statement that this is the simplest hypothesis to explain a number of phenomena of whose existence I am dubious, and which, if they are true, could perhaps be explained otherwise.

In order to show how so-called miracles are being gradually explained away by the progress of science, we will examine one of the remarkable cures described in *The Miracle at Lourdes*, namely, that of a blind woman called Mme Biré. She was blind as the result of optic atrophy, due, says Father Woodlock, to some cerebral cause. How does he know, by the way, that it was not due to some spirit or other? She recovered her sight suddenly at Lourdes. He does not mention, by some curious oversight, that somewhat over 10 per cent of cases of this disease recover to a considerable extent without any treatment, and are often capable of reading. On examination the retinae were found to present the appearance of the disease, and a doctor pronounced that she must therefore be blind. "The function," says Father Woodlock, "had been given back before the organ had returned to its normal condition." A Dr. Cox further added, "It seems as though the Almighty were having a little joke with us medical men."

It seems even more probable that the medical men at Lourdes are bad diagnosticians. In Bell's monograph on hereditary optic atrophy I read: "It is a notable fact that once the disc has attained these atrophic signs, it never recovers its normal appearance even though the sight may so markedly improve as to allow of reading and close work." The one surprising feature of the case is that a month later the appearance of the optic nerve was certified as normal.

But in view of the ignorance of three doctors mentioned in the tract, I feel that this latter statement needs confirmation. If I knew the literature of other diseases as I happen to know that of optic atrophy I might find some of the other miracles more easily explicable than they appear to me in my present ignorance.

By the way, you bring up two mathematical topics on which I cannot share your opinions. You accuse me of sympathy with a slight scepticism as to the truth of the multiplication table, and say (without any particular basis, but it reads very nicely) that your doubt of the reptilian ancestry of archaeopteryx provokes my indignant scorn. So I must explain why I think it rational to examine one's reasons for believing in the multiplication table. The statement $2 \times 3 = 6$ means, I take it, something like this. "If there are any two sets of three beings, then the total number in these two sets is six." (Two, three, and six are defined by addition). Now I think this is true, but I am willing to consider the possibility of exceptions to it. And, curiously enough, you (and Mr. Chesterton who raised this point) must believe in them.

You believe in the Father, the Son, and the Holy Ghost. Each, you believe, is God. But yet there are not three Gods, but one God. And if you disbelieve that in this particular case $3 \times 1 = 1$, without doubt, according to the Athanasian Creed, you will perish everlastingly. Now I don't believe in the Athanasian Creed. But in my wilder moments I have, I confess, toyed with the idea that the above creed might be true, and hence, the multiplication table, as a statement of universal truth, false. However, I will try to repress these rather unruly thoughts in future, if that is your desire.

You also appear to object to the people who regard Euclid as (in some respects) out of date, and seem to think that his propositions cannot be criticized without dragging in non-Euclidean geometry. This is not the case. Take his first proposition. Here, in order to construct an equilateral triangle on AB he describes two circles with centre A and radius AB, and with centre B and radius BA. He assumes without proof that they intersect. Now this is true on a

plane, but can only be proved by means of the parallel postulate. For it is obviously not true on a sphere, as is clear if we consider the earth as a sphere, and A and B are points in London and Sydney. You can reply that it is obvious that the two circles, if on a plane, will intersect. But Euclid proved many obvious propositions, for example that the line joining two points on a circle falls within the circle (III, 2). The fact that this *non sequitur* in his first proposition escaped notice for two thousand years shows that, as regards reasoning, the ages of faith had something to learn from this age of doubt.

May I explain briefly why I think it more reasonable to doubt a mathematical theorem than a well-established case of evolution, e.g. that of the horse. The former is a statement about *all* classes or objects of a certain kind, e.g. all right-angled triangles, and we certainly cannot examine them all. The latter is a statement about history, like "Queen Anne is dead," and we can examine the evidence for it in detail.

We now leave this rather futile but, I fear, necessary discussion, and return to St. Thomas. You will remember that he produced some not wholly conclusive arguments for the existence of a first cause, which he described as an unmoved mover, or more accurately translated, an unchanged changer. Also there is a first efficient cause, something necessary in itself, and a cause of being, goodness, and other perfections. Finally, there is an intelligence which orders natural objects. All these are regarded as identical with one another, and given the name of God.

Now follows some rather difficult argument, with which I do not wholly agree, though it is better than the argument for a prime mover. As the result of this argument he arrives at the following very remarkable conclusions, which I give in the language of the Dominican friars who translated the *Summa contra Gentiles*. The references are to the first book.

"For the divine essence by its immensity surpasses every form to which our intellect reaches, and thus we cannot comprehend it by knowing what it is. But we have some knowledge thereof by knowing what it is not. . . ." (Chapter XIV.)

"That God is not in any genus." "Wherefore it is likewise evident that God cannot be defined; since every definition is composed of genus and difference." (Chapter XXV.)

Now if these statements are true, they refute the proofs of God's existence given earlier. For example, in these God is described as an unmoved mover, as is the soul in Chapter LXV of Book 2. But this is a definition of God by genus (mover) and difference (unmoved). Also if we know that God is a mover, a cause, and so on, we know something positive, not negative, about the divine essence. Similarly it is incorrect to say that God is a spirit, or an intelligent being, for these are positive statements about his essence, and make him a member of a genus.

St. Thomas later says that we can apply the same terms to God and creatures analogically, because God is the cause of perfections in creatures. But this is unsatisfactory for two reasons. First of all, there is no mention of analogy in the alleged proofs of God's existence. There God is not written of as something like a first cause, but as a first cause. Secondly, the assumption is made that the cause contains all the perfections of its effect. If this is so there is no real novelty. God foreknows everything, for example, and man is incapable of goodness by his own efforts. Now I regard this doctrine as probably false. I think that there are such things as real novelty and progress, for example that by the writing of a great poem, a new perfection is added to the world. If there is real novelty, the First Cause is a matter of mainly historical interest. It is not as important as the Last Effect, to which perhaps you and I can contribute.

You see then that St. Thomas's arguments disprove one another. He arrives at a certain theory about God, and this theory is self-contradictory. When Euclid got a self-contradictory result from his premises he added "which is absurd," and abandoned those premises. The correct conclusion from St. Thomas's chains of thought seems to be as follows: Certain arguments tend to prove the existence of a first cause. But if there is a first cause we cannot know what it is, or even that it is a cause, or first. Hence these arguments contain a fallacy.

Many philosophers have come to this conclusion. Thus

Kant held that reasoning as to a first cause inevitably led to antinomies. A few, like Herbert Spencer, have believed in an unknowable. Others have held that it was impossible to arrive at knowledge of God by reason, and have trusted in revelation.

But the general tendency among scientists has been to try to extend the chain of causation as far back as possible. This attempt has been conspicuously successful. It has given us the science of geology in place of the myths of the book of Genesis. At present we cannot argue back beyond a period of about two thousand million years ago. A century ago, before scientists took over the job from theologians, the world was generally thought in Europe to be only about six thousand years old. As our knowledge increases I can see no reason why this period should not be extended without limit. You will, of course, be able to cite numerous scientific men who regard this attempt as impossible. This will not convince me, because I remember the arguments of such pious scientists as Lord Kelvin to prove that the sun could not be more than about a hundred million years old, arguments which seemed conclusive enough at the time, and were dispelled by further knowledge.

I do not deny, therefore, that the universe may have had a beginning. I merely claim that it is unscientific to assume this theory, unless no alternative presents itself, that this is not at present the case, and that if it were so we should probably be led into contradictions similar to those encountered by St. Thomas.

Yours sincerely,
J. B. S. HALDANE.

XXIV.

THE AQUINATE PROOFS

2 Albany Courtyard,
Piccadilly, London, W.1.
May 2, 1934.

My dear Haldane,

I have left your letter of September 9th unanswered for many months since it seemed best to complete our discussion of the physical arguments for the existence of God before dealing with the metaphysical arguments. In your September letter you perpetuate the theory, invented by scientists for their own protection, that there is no distinction between attacking science and attacking scientists, and you express your disappointment at my failure to attack the "validity of the scientific method." Why should I attack a method the application of which must lead a man to the threshold of the Church? What I attack is your failure to apply the scientific method to the evidence for the supernatural.

Why should I quarrel with science? "Science" is a Latin word meaning knowledge, and it is not the knowledgeable man who says in his heart "There is no God." The modern quarrel is not between religion and science but between science and nescience, and in this debate Christianity and science are firm allies.

"It is true," as that great scientist, Lord Rayleigh, remarked in his presidential address to the British Association, "that among scientific men, as in other classes, crude views are to be met with as to the deeper things of Nature; but that the lifelong beliefs of Newton, of Faraday, and of Maxwell are not inconsistent with the scientific habit of mind, is surely a proposition which I need not pause to refute." Unfortunately, it is the exponents of "crude views" who are encouraged by the public to pontificate on matters outside the sphere of science. Scientists who are also philosophers—the combination, though rare, is not unknown—would agree with Lord Rayleigh that the scientific worker has no claim "superior to that of other people to assume

the attitude of a prophet. In his heart he knows that underneath the theories he constructs there lie contradictions which he cannot reconcile."

Meanwhile, it is, I suppose, sound tactics on your part to represent me as an enemy of science and scientists because I don't regard every man who knows one end of a test tube from the other as an inspired seer. If you were prepared to agree that intolerance is a universal failing, from which neither theologians as a class nor scientists as a class are wholly free, we should soon reach an accord, but you persist in maintaining the odd thesis that scientists as a class are distinguished by tolerance, by generosity, by willingness to admit error and to accept correction. Nothing in your own letters bears out these exaggerated claims.

You will persist in regarding my views on this subject as private whimsies of my own, though I have reminded you again and again that they are based on statements made by eminent scientists, such as Huxley's statement to the effect that jealousy and pedantry are the besetting sins of scientific men. "Science," wrote Huxley, "is no purer than any other region of human activity." I agree with Huxley. You don't.

And now for St. Thomas.

Professor A. E. Taylor describes St. Thomas Aquinas as "one of the great master-philosophers of human history whose thought is part of the permanent inheritance of civilized Europeans and whose influence is still living and salutary." Professor T. F. Tout describes him as "one of the foremost names in the history of thought." Neither of these two distinguished Mediaevalists is a Catholic, but both of them would condemn your "feet on the fender" attitude to that very great man. Frankly, you have disappointed me. I gathered that you took your criticisms of St. Thomas seriously, and was expecting some food for thought. I had my misgivings, for your remarks about transubstantiation and your reference to "the impossibility of an infinite regress" in an earlier letter proved that you had not taken much trouble to understand St. Thomas. But I had hoped that my warning about "infinite regress" (in an earlier letter)

might send you to some elementary text-book on Scholasticism. I was wrong.

To criticize the arguments of St. Thomas on the assumption that they are physical is as elementary a blunder as to confuse Aristotle's theory of knowledge with Locke's. I admit, however, that St. Thomas helped to put amateurs on the wrong track in the first argument, for it requires some knowledge of St. Thomas's background to realize that "*hic*" is the operative word in the sentence *Hic autem non est procedere in infinitum.*

Your eloquent attack on the arguments against an infinite regress would be more impressive if St. Thomas had not anticipated you, and attacked the very theory which you accuse him of upholding. Christians believe that the world was created at a definite point in time, and consequently the universe has not existed from all eternity. Theologians were therefore encouraged to try to show, not by revelation but by philosophy, that the world must have been created. St. Thomas's predecessors professed to be able to supply the necessary proofs, and St. Thomas caused considerable scandal by showing that these professed demonstrations were invalid. To appreciate the disturbance this created, we must imagine, as Professor Taylor remarks, the kind of scandal that would have been produced in the early sixties of the last century if an eminent divine had asserted that all the arguments whereby the opponents of Darwin were trying to refute him were completely invalid.

"To the contemporaries of St. Thomas," Professor Taylor continues, "the assertion that there are no sound philosophical arguments against the creation of the world from eternity involved at least as great a revision of traditional thinking as the doctrine of the origin of species by natural selection demanded of our grandfathers."

You should really read some simple introduction to scholastic philosophy. If you distrust works by Catholics, such as the admirable books and treatises by Father D'Arcy or Professor Gilson, read a recent book by a non-Catholic, *The Conception of God in the Philosophy of Aquinas* by Dr. R. L. Patterson.

There are all sorts of points which I should like to take

up, such as your curious confusion between the infinite divisibility of a continuous line, and the possibility of an infinite number of real changes in real entities.

But I won't waste time over minor points. It is simpler to begin *de novo*, and to ignore your travesty of the arguments, and to summarize the argument itself.

The first three proofs of St. Thomas are really aspects of one and the same argument, which can be summarized as follows. A succession of dependent entities each of which refers us to the preceding member can only be rendered intelligible by assuming the existence of something which explains them, and which is at the same time its own explanation. He is not arguing, as you suppose, that an infinite regress is impossible, but that an infinite regress does not help you to get rid of contingency and dependence. Even if you go on *ad infinitum* you will still be left with dependent and contingent entities. Here is a passage from Dr. Patterson's book:

"Hence it is beyond question that he held it to be entirely illegitimate to argue to the existence of God from the supposed necessity of a *prius* to the temporal series. On the contrary, his contention was that any and every causal series, whether temporally finite or infinite, is inherently contradictory unless regarded as depending upon an ultimate cause which is not in time at all. In any such series each member is moved by its predecessor, and this in turn by the member previous to it, and though we proceed in this manner to infinity we are no nearer reaching an ultimate and self-explanatory source of motion."

Professor Taylor, again, sums up admirably St. Thomas's arguments: "The dependence meant in the argument has nothing to do with the succession in time." Consequently your whole criticism falls to the ground.

"What is really meant," Professor Taylor continues, "is that our knowledge of any event in nature is not complete until we know the full reason for the event. So long as you know that A is so because B is so, but cannot tell why B is so, your knowledge is incomplete. It only becomes complete when you are in a position to say that A is so because Z is so, Z being something which is its own *raison*

d'être, and therefore such that it would be useless to ask why Z is so. This at once leads to the conclusion that since we always have the right to ask about any event in Nature why that event is so, what are its conditions, the Z which is its own *raison d'être* cannot itself belong to Nature. The point of the reasoning is precisely that it is an argument from the fact that there is a 'Nature' to the reality of a 'Supernature,' and this point is unaffected by the question whether there ever was a beginning of time, or a time when there were no events."

The "gross and obvious fallacy" which you have discovered in the third proof exists only in your imagination. What St. Thomas actually said was completely different from what you represent him as saying. But I admit that the third argument might possibly have been elaborated if St. Thomas had realized that he was writing not only for his contemporaries, not only for the trained reader who could follow his compact thought, but also for amateurs who could not.

In effect his argument comes to this: If a thing can perish, then clearly it does not necessarily exist, that is to say, existence does not belong to it by reason of its own nature. It is not self-sufficient, and does not give a sufficient reason for its own existence.

Many misunderstandings would have been avoided had the expression "uncaused cause" been substituted for the expression "first cause." The argument for the "uncaused cause" has been admirably summed up by Mr. Alfred Noyes in his book *The Unknown God*. He writes as follows: "No philosopher has yet asserted (so far as I know) that nothing exists at all. If anything does exist, then—unless there is some other ultimate Being—it is itself the ultimate Being, and the man who asks with so wise an air, 'Where did the ultimate Being come from?' has actually discovered, without knowing it, the whole ground of religion. It is just because there is no possible answer that we say of Being, in its ultimate aspect, that it is supernatural. At whatever ultimate our reason allows us to halt, the one absolute mystery is there. The naïve question does not alter or abolish that one silent but tremendous Fact."

As I do not myself find the fourth argument very convincing, I will not attempt to deal with your objections to it.

You open your criticism of the fifth argument with an imaginary reconstruction of St. Thomas's attitude to the world around him. St. Thomas emerges from your brief sketch as a person whom you can patronize, which must be very comforting. Poor old St. Thomas! He couldn't have handled those infinite series which have long ceased to bother the modern mathematician. He would not have felt at home with $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$. Moreover, St. Thomas was silly enough to believe that the earth had been designed for man's habitation, and in his naïve fashion regarded the stars as arc lamps which had been lit for his convenience.

Finally we are invited to distrust St. Thomas's argument because poor old St. Thomas had never heard of the worm *Bilharzia*. He had heard of noble animals like the wolf and the lion, the viper and the poisonous adder, hornets and other irritating insects, including the noble bug, which was perhaps not so much a nuisance before the Fall as it is to-day, but he had never heard of *Bilharzia*. If he had, one vaguely gathers, he would have thrown the *Summa Theologica* into the fire. For the worm *Bilharzia* has thrown a new light on the problem of evil. He might, one gathers, have succeeded in reconciling the existence of a good God with plague and famine, with earthquakes and volcanoes, with the murder of the Innocents, and with children dying in hopeless pain. God could get away with a good deal, but not with the worm *Bilharzia*. This was a bit too steep.

I am pleased, however, to note that in one respect science appears to confirm the mediaeval view which was so cheerfully derided by the Victorian scientists. Many years ago the Christian was scolded for his conceit in imagining that this earth had been the centre of an important experiment. He was told that space simply teemed with inhabited planets. The earth was not, as our mediaeval ancestors had supposed, the centre of the universe. Modern science, however, suggests that the mediaeval view may have been correct. The earth may conceivably be the only inhabited planet in the universe. Be that as it may, science confirms the view with which you credit St. Thomas, the view that "the earth

appeared to be designed to harbour men and animals." You yourself admit that "our planet is one of the rare nooks in an inhospitable universe where we could possibly exist." A happy accident, as you say. But, as I showed in my last letter, there must surely come a time when an honest critic can no longer plead coincidence or accident as the alternative to the belief in God. "These are no mere accidents," as Professor Henderson remarked of those properties of carbon, hydrogen, and oxygen which are uniquely favourable to life. "An explanation is to seek," he added, and perhaps St. Thomas's explanation is the right one after all.

Life on this planet is only possible for one of two reasons —either because God made this planet as a habitation for men or as the result of a series of fantastic coincidences, so fantastic as to strain the credulity of all but the most hardened of atheists. "The picture of the world as drawn in existing physical theories," writes Eddington, "shows arrangements of individual elements for which the odds are multimillion to one against an origin by chance." If we reject origin by chance, we must accept St. Thomas's alternative, origin by design.

In your remarks about St. Thomas's fifth argument you provide yet another illustration of the fact that the amateur nearly always goes wrong in criticizing St. Thomas. You make the familiar mistake of confusing St. Thomas's fifth argument with Paley's argument from design in *nature*. St. Thomas bases his case on the subjection of *all* things to the guidance of law.

You do not refute St. Thomas's fifth argument by attacking the intelligence or benevolence of the alleged designer. All that St. Thomas is attempting to prove in this argument is that all things are governed by mind. I am not suggesting, as you seem to think, that all is for the best in the best of all possible worlds. I admit that the phrase *Consequuntur in quod est optimum* is slightly misleading, but only to those who have forgotten his attitude to evil which he nowhere treats as a mere illusion. True, he had not heard of your friend *Bilharzia*, but he had met one or two people who deduced that God was not perfect from the fact that "*principia rerum videntur esse imperfecta*," and you will find

his reply in the *Quaestio* which treats *De perfectione Dei.* In the fifth argument he is concerned to prove not that God is perfect but that God exists.

I was amused at your kindly excuse of St. Thomas's bad arguments. They were bad, you tell me, because they were never clarified by argument. It would have been unwise, you suggest, for an opponent to argue with a Dominican friar. If you knew anything of the controversies of his day you would not make the mistake of thinking that orthodoxy was all-powerful in the thirteenth century. The thinly veiled pantheism of Averroës made a great impression on the University of Paris.

I was interested in your criticism of the argument from entropy, and should like to hear Sir James Jeans reply. I prefaced my own summary of those arguments in a recent book with the following warning: "I am reluctant," I wrote, "to hitch the wagon of faith to the shooting star of scientific fashion. For all we know, relativity and the quantum theory and entropy will one day join their predecessors in the limbo of discarded scientific fads."

It would be easier to follow modern discussions about space if modern scientists were as careful as the mediaeval theologians in the definition of their terms. What exactly do you mean by "universe"? Do you mean *our* space or every space? If you mean our space, then I agree that the universe may be "a finite system of a certain type." In this case our universe would be suspended in a hyper-space continuum. If, on the other hand, the word "universe" means, as it should, the sum total of reality, it is surely absurd to talk about space expanding. Expanding into what?

These discussions by modern physicists confirm the fact that finite mind is reduced to impotence when confronted with the problems of the infinite. It is very odd that you people who are so ready to poke fun at the mysteries of the Christian faith are so oblivious of your own difficulties in your attempt to discuss the mysteries of space. The jaunty confidence of your approach to these ultimate problems is far removed from the spirit of the Athanasian creed, with its reverent admission of unsolved mysteries and its readiness to kneel in reverence before the ultimate incomprehensible.

"He who proclaims," wrote Pasteur, "the existence of the infinite—and no one can escape doing so—gathers into his assertion more of the supernatural than is to be found in all the miracles of all the religions: for the idea of the infinite has a double character, it commands belief, and yet it is incomprehensible"

"And yet it is incomprehensible . . ." Precisely. And to the comprehension of this great mystery modern discussions about relativity and expanding space contribute nothing.

Yours sincerely,
ARNOLD LUNN.

XXV.

MIRACLES

2 Albany Courtyard,
Piccadilly, London, W.1.
May 10, 1934.

Dear Haldane,

By dismissing as "red herrings" those questions of mine which you wish to evade, you naturally keep your letters shorter than mine. This letter will be a long one, and I am sure you will agree with me that it would be best to deal thoroughly with the big fundamental issue of the supernatural versus the mechanical explanation of creation in this book rather than attempt to cover a wider area in a necessarily more superficial fashion.

First, a few minor points. St. Clement of Alexandria was trying to make clear a distinction which you will not see, the distinction between allegory and scientific fact, or, if you wish, between poetry and prose. Sir Ambrose Fleming was elected to the Royal Society not as a biologist, but as a distinguished authority on electrical engineering. His book attacking Evolution appeared many years after his election to the Royal Society. I have never maintained that there is a general boycott of anti-Darwinists. I know, just as well as you do, that anti-Darwinists have risen to great eminence in the Royal Society. But I do maintain that it would be difficult, if not impossible, for any biologist who was known not to believe in Evolution to be elected to the Royal Society or to obtain any important post in any modern university. You have so far failed to produce a single fact to shake my conviction on this point.

Your defence of the rejection of Dewar's paper is unconvincing, and as I did not suggest that the Zoological Society rejects articles attacking Darwinism, I am uninterested by the evidence which you offer on this point. Whether this journal is "an entirely unsuitable journal for a critical review of palaeontological ideas" is a question of opinion. Whether it publishes such articles is a question of fact. Its "Proceedings" for one year contained no fewer than eleven

contributions on palaeontology, several of these dealing exclusively with extinct genera. Dewar's paper dealt with the distribution of *living* genera, and was therefore even more suitable for a society which specializes in the collection of living genera. It contained a mass of information which had not been collected previously.

It is, I agree, quite impossible to prove conclusively that T. H. Huxley, Acworth, Samuel Butler, and Dewar have been refused a hearing because they are scientific heretics. Nor would it be easy to show that Thomas Huxley himself was correct in believing that a "very original and important paper" would never see the light of day because it would be suppressed by jealous scientific pundits. "Science," wrote T. H. Huxley, "is, I fear, no purer than any other region of human activity. Merit is very little good. It must be backed by tact and knowledge of the world to do very much." That is my case. The reader must decide, not so much between Haldane and Lunn as between two eminent scientists, T. H. Huxley and J. B. S. Haldane.

My statement that *Nature* completely ignored "fifty years of scientific research" was an understatement. Home's mediumship attracted widespread attention in the British Press in 1855. In 1924, you tell me, *Nature* first paid serious attention to these phenomena. In other words, sixty-nine years, rather than fifty years, of psychical research had been ignored up to that point. The date I gave, 1926, was wrong. I made it clear that I was quoting from memory, and it is possible that what Sir Oliver actually said was that until 1926 *Nature* had not admitted a first-hand description of experiments in psychical research. Be that as it may, I must not deprive you of the satisfaction which you have obtained from pointing out that a branch of scientific research which attracted widespread attention in 1855 was noted by *Nature* for the first time in 1924, and not, as I have said, in 1926. But the difference between sixty-nine and seventy-one years of neglect does not strike me as vital.

I am touched by your tenderness for your brother-scientists whose names you withhold to protect them from my "abuse." I wish you would define "abuse." True, I have described an anonymous reviewer as an ass, but I

should not have done this had not his anonymity effectively protected him from "abuse." "Personality" by definition concerns a person, and anonymity is from its very nature impersonal. The main difference between us is that whereas you have implied very definitely that many of those whom I have quoted as authorities are asses, I have described an unknown, unnamed reviewer as an ass.

You have held yourself free in this correspondence to pour contempt on men whom Catholics revere, and I have welcomed your freedom of expression, for I believe that in debating matters of fundamental importance both sides should be free to describe as bosh what they believe to be bosh.

It is an accepted convention in the modern world that atheists and modernists must be free to say exactly what they please about Catholics, but that no Catholic should exceed the limits of genteel remonstrance. My friend, St. John Ervine, for instance, read me a very severe lecture the other day because I made a joke at the expense of Bishop Barnes. He thought this very bad taste indeed. But he has recently stated in the columns of the Press that Catholicism is a religion for actors and servant girls and not for gentlemen.

As to your mathematics. Will you tell me whether you claim to explain (*a*) the origin of life, (*b*) the origin of those mutations, the laws of whose distribution might conceivably be determined on mathematical lines? Can you please tell me the name of any eminent scientist who was a convinced anti-Darwinian before you published your view, who is a first-class mathematician, and who has been converted to your view as a result of studying your mathematical theory?

You have not, it would appear, converted Professor MacBride. I find in the April issue of *Nature*, one of those scientific papers which you accuse me of not reading, Professor MacBride writes as follows: "From the study of the few cases in which mutations have been experimentally produced by such agencies as X-rays, heat, etc., it may be concluded that they are due to some damage to the developmental machinery of the nucleus in the germ cell." And

if it be true, as he states, that these mutations disappear in a limited number of generations if the organism is replaced in its natural environment, then clearly your experiments prove nothing.

I should be readier to believe that your mathematical theory was sound if the unsound remarks about broody birds, on which I have already quoted Heseltine's comments, had not appeared in the middle of your mathematical appendix. Your reluctance to admit the famous passage about the moths' blunder leads me to suspect that, so far as Darwinism is concerned, your reasoning powers, which I respect, are clouded by a passionate desire to arrive at a Darwinian conclusion. Your latest wriggle on this point doesn't help matters much. St. Thomas at the beginning of each *Quaestio* stated clearly exactly what he intended to prove. You now ask us to believe that you were intending to prove something which is nowhere alluded to in the Essay in question, the fact that certain compensating advantages can offset the disadvantage which arises from the absence of protective colouring. Your Essay is headed "Darwinism To-day," and the long paragraph about the moths contains no hint to suggest that you have any object in view other than to establish the truism that protective coloration is an advantage. Much of the confusion in scientific writing would be avoided if scientists made an effort, wherever possible, to use short words instead of long. Let us translate the thesis of this paragraph into words of one syllable. "White moths show up more on dark pines than on light birch. Owls eat more white moths on dark pines than white moths on light birch."

How true! What bearing these truths have on the power of Natural Selection to transform species, that is to say, on the title of your Essay, "Darwinism To-day," heaven alone knows.

You ask me to withdraw my statement that you sweep aside as grotesque the belief that no true intermediates have been discovered between the great phyla. Perhaps you would re-read your paragraph about Berg, beginning "And unfortunately these missing links do keep on turning up," and tell me how you can reconcile this paragraph with your

indignant demand for withdrawal. I should be only too happy to record your agreement with the view that, so far as the geological record is concerned, there is no evidence whatever for a series of links between the great phyla.

Your reaction to the *Daily Telegraph's* description of a carnival procession in Ireland is a little humourless. I am sorry the huge model of the big black cat shocked you. Dear me! You will be telling me next that Catholics still believe in giants because you have seen giants walking on stilts in a carnival procession at Nice.

No Catholic claims that the Church has been completely successful in the war which it wages against superstition, but you do not refute my statement that superstition increases with the increase of so-called rationalism by reminding me that some Catholics are still superstitious any more than you would refute the statement that immorality increases with the decline of institutional religion by proving with immense triumph that Catholics still commit adultery.

Your attitude on this point is a good example of the fact that accusations against the Church often cancel each other out.

At one moment we are scolded because the Church is not sufficiently severe in repressing the superstitions in southern Italy. At another moment we are lectured on our intolerance because the Catechism prohibits all "superstitious practices, such as consulting spirits and fortune-tellers, and trusting to charms, omens, dreams, and such like fooleries." And now for the contrast between Haldane the tolerant and Arnold Lunn the intolerant.

We do not, as you claim, differ materially in our views on liberty, for we are both agreed, I take it, that inexperienced people should be protected from grave dangers. We merely disagree as to what is gravely dangerous. You do not protest in the name of liberty against regulations which hedge in the sale of poison. Now the Catholic, rightly or wrongly, believes that spiritual infection may be as dangerous as bodily infection, and that demoniacal possession, for instance, may have effects more tragic than the effects of

poison. You are entitled to declare yourself unimpressed by the evidence which leads the Catholic to this conclusion, but it is unfair to confuse what should be a calm discussion of evidence by a mere appeal to prejudice. For our verdict will be determined, not by any difference in our theories of tolerance, but by our interpretation of certain facts.

I have a very great respect for the dangerous experiments which you made during and since the war with poison gas, and for your own courage in using your own body as a laboratory for research, but I do not suppose that you would incite your less experienced pupils to repeat those experiments. Why should you, therefore, attack Catholics for intolerance merely because they consider that only trained and approved investigators should undertake a form of research which they consider dangerous?

Catholics would agree with you that "sane adults should be allowed to do all sorts of things from which they are unlikely to gain much benefit." You think that adults should be allowed to go to dog-races or Catholic services, and we think that adults should be allowed to take tickets in the Irish Sweep or to read your books. But I must be careful, for it is all very well for you to bracket dog-races (which you give the precedence) with the Mass, but I shall be attacked as abusive if I adapt my style to yours.

Your references to the Athanasian creed would have struck me as very clever at the time when I myself was learning the Catechism. But I expected something better from a man who is so free with his quotations from St. Thomas. The Athanasian creed says, *Neque confundentes personas neque substantiam separantes*, and makes clear the distinction between person and substance. This creed tells us that there can be three personalities to one substance, just as there can be five fingers to one hand. The Athanasian creed does not teach us that three persons equal one person or three substances equal one substance or five fingers equal one finger.

My protest on behalf of Euclid and the multiplication table is provoked by my belief that there is a causal connexion between two fundamental defects in modern thought—agnosticism about things which are certain, such as the

multiplication table, and dogmatism about things which are, at best, possible, such as Evolution.

I know that Euclid's *methods* of proof have sometimes been open to criticism, but I deny that the truth of his propositions has been affected by modern mathematics. It seems to me extremely foolish to suggest that propositions which, by hypothesis, are only alleged to be true of two dimensional space, have been superseded or shaken merely because we can show that they are not true of three or of four dimensional space. Your remarks about the sphere are irrelevant. Euclid would have been the first cheerfully to admit that circles drawn with centres at London and Sydney with a radius equal to the distance between London and Sydney need not necessarily intersect.

We have learnt a great deal since Euclid's day, and we can conceive the possibility of kinds of space which Euclid never conceived; but "as it was in the beginning, is now and ever shall be," the square on the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides. This truth will always be true of the only kind of right-angled triangle with which Euclid was concerned, the two-dimensional triangle.

And if you really believe that it is necessary to examine every right-angled triangle in the universe before expressing your unshaken confidence in this proposition, then I can only express my amazement that you should expect us to accept Darwinism on the strength of your mathematical equations. Moreover, if you were really "willing to consider the possibility of exceptions to the statement that twice three equals six" you would be reduced to such a condition of muddled scepticism that your beliefs would be as uninteresting and as unimportant as your unbeliefs. My sincere respect for your abilities leads me to hope that you yourself don't take this pose very seriously.

So much for minor points. Now for the big issues. First as to Vialleton. A scientist, whose name I shall not mention lest I should expose him to your abuse, told me that, in his opinion, Vialleton's *Membres et Ceintures des vertebres tetrapodes* is the best book of its kind. Have you read it, and, if so, what do you think of it?

A scientist whose predictions are verified is naturally more impressive than a scientist whose predictions are not. When Mendeléef propounded his periodic law he pointed out that if his theory were true there must exist a number of unknown elements of which he was able to give approximately the atomic weight. I believe that many of these have since been isolated. The early Darwinians predicted the discovery of pro-Aves, pro-Cetacea, pro-Chiroptera, etc., which have not been discovered. Ten years ago Vialleton not only asserted that it was futile to seek for a series of intermediate forms between a land mammal and a cetacean or a Sirenian, he argued that a half-way form could not exist and propagate itself in competition with other creatures: a bold statement, which could have easily been upset by the finding of any one of the hundreds of intermediate forms that must have lived for millions of years if the Darwinian theory be true. Please note that these half-land, half-aquatic intermediaries would live near the coast, precisely in places where most of the fossil-bearing geological beds were laid down. Vialleton made this prediction ten years ago, and unlike the predictions of Darwinists, his prediction has so far been fulfilled. No fossil has been found to give him the lie.

Now as to the Dewar statistics. As we know 100 per cent of living European mammals as fossils, but only 46 per cent to 90 per cent in other continents, our knowledge of the record is admittedly incomplete, and we must expect to find new fossils turning up, especially outside of Europe. The figures you quote, however, are not particularly impressive, for in the first place they include living genera *not* found as fossils, a fact which you ought to have mentioned; and in the second place these statistics seem to have been influenced by the modern tendency to split up genera indefinitely. The truth is that zoological scientific nomenclature is in a state of chaos. Among the specimens which are listed as new genera in the figures you quote are a single molar tooth, a slender basis on which to found a new genus, and the Piltdown jaw.

Your estimate of the duration of the Tertiary was based, I suppose, on the results of radioactivity. This new method

of measuring geological time has been severely criticized. We will go into all that if you want to. But for the moment I will content myself with pointing out that your criticism is very superficial, for you make the mistake of assuming that each of the genera cited by Dewar is known as a fossil in only one of fourteen periods. Actually less than 20 per cent of these genera occur in one period only. Dewar claims that if he were to split each of his periods into a hundred thousand sub-periods, we should still find at least forty-five genera in each period represented in fossil form.

My knowledge of comparative anatomy may be slighter than yours of St. Thomas Aquinas, but I shall not meet your case against theism by assuring you that if you worked for a year at a Catholic seminary you would realize that the arguments for God were irresistible.

The case for Evolution is based on evidence which the layman is just as capable of appreciating as the expert. You imply that you have contented yourself with meeting my objections to Evolution, and have made no attempt to state the case for Evolution. Lest the reader should believe that you have in reserve an armoury of weapons, it may be best to summarize the arguments whereby Evolution is defended.

The record of the rocks suggests that the simplest forms of life appeared at an earlier date than the more complex. So does Genesis. Even the most ardent of fundamentalists do not claim that fishes, birds, and men appeared simultaneously on the surface of the globe. Consequently the progression of forms from the simpler to the more complex is no evidence against special creation, and is equally consistent with Evolution and Fundamentalism.

The Evolutionists base their belief on five main lines of argument, of which the first two are completely unconvincing. These are (1) the results of artificial selection, (2) the evidence of minor evolution in the geological record.

These first two arguments merely establish a fact which no anti-evolutionist denies, the fact that small changes take place within the framework of definite limitations, but minor evolution, as we shall soon see, so far from proving major evolution, tells against it.

The remaining arguments resolve themselves into an

appeal not to facts, but to intuition. We are invited to believe in Evolution because (3) God would not be so untidy as to leave vestigial organs lying about in the human body, (4) God would not be so deceitful as to produce by special creation a distinct type with anatomical resemblances which strongly suggested a common ancestor, (5) God would not be so deceitful as to produce by special creation two separate types with similarly constituted blood, (6) God would not provide the human embryo with something which looks like a tail unless he wished us to believe that men were descended from apes.

But the Evolutionist who does not share your confidence in your competence to decide, on *a priori* grounds, how the God in whom you don't believe would set about the business of creation has very little to fall back upon but simple Faith once Evolution is challenged. I agree with you that if I worked for a year among fossils my imagination would be so impressed with the resemblances between the allied types which I was handling that I should entirely forget the absence of the missing links. That is the worst of "missing links"—one is so apt to miss them.

Indeed, I suspect that the longer I worked among fossils the more difficult I should find it to arrive at an unprejudiced verdict. You know the old definition of a specialist, "A man who knows more and more about less and less, until at last he knows everything about nothing."

You tell me that if I were to read scientific periodicals I should begin to appreciate "the sort of evidence on which science is based." If I did not appreciate "the sort of evidence on which science is based" it is unlikely that I should be considered to have contributed something of value to that branch of science which deals with snow and with avalanches. It is, indeed, precisely because I do appreciate the contrast between the evidence on which science, and the evidence on which popular science, is based, that I still refuse to accept Evolution as proved.

Science, and divine science, as St. Thomas Aquinas describes theology, are based on much the same sort of evidence, on facts more impressive than the fact that white moths show up less on white than on dark trees.

A man may be a first-class scientist and a very indifferent philosopher.

Sir Arthur Keith is a case in point. A first-year student at Maynooth would know better than to present the case for God by arguments as illogical as those with which Sir Arthur supports the case for Darwinism. He makes a great point, for instance, of comparing the evolution of mechanical inventions with the evolution of man, in apparent ignorance of the fact that any improvement in, say, a watch or a motor-car represents a "special creation." The analogy, therefore, could be used with equal success to prove that the Rolls-Royce is the blood relation of the Ford, or that every individual man, like every individual motor-car, is specially created.

I don't think you have made any serious attempt to meet the case against Evolution. You have ignored persistently the question which I have put to you more than once in this correspondence, Why should the evolutionist be permitted to draw definite conclusions, and the anti-evolutionist forbidden to draw definite conclusions, from the absence of fossils in a given stratum? Please answer this. Nor have you made the least attempt to explain the absence of intermediate links between the great phyla. Minor evolution, on which you laid such stress, really tells against the hypothesis of major evolution. The mere fact that we can trace a series of minor changes between, say, different generations of the micraster or zaphrentes, makes it all the more surprising that we can find no trace of major changes which went on during a far longer period of years. You tell me cheerfully that you have no doubt that many of the missing ancestors will be found in view of the rate at which new fossils are being found. The future is going to be very hard worked if it has to provide you not only with the evidence for major evolution, none of which so far exists, and also with the kind of evidence which you need to explain away miracles.

I have a quaint bias in favour of forming my conclusions on the evidence before the court. You appeal to the jury to remain seated for an indefinite period of years in the hope that something may turn up to influence them in your favour.

My scientific conscience forbids me to declare a theory as being proved when no explanation has been offered to meet the overwhelming difficulties of that theory. No plausible suggestion has been brought forward to reconcile the rate at which fossils have turned up, and are turning up, with the complete failure of the geological record to provide a series of intermediate types, which on any theory of evolution must be at least as numerous as the types which they link.

The absence of these intermediate types is not the only difficulty. It is almost impossible to make any plausible suggestion for the method by which certain types, supposed to be related, could in fact have been linked. If you doubt this, try and make a series of, say, thirty sketches showing (1) the skeletons, particularly the pelvis and limb bones, and (2) the musculature, particularly of the hind limbs and tail, of the intermediaries between any land animal and a cetacean, illustrating the mode of locomotion in each case, and showing the stages which separate the ancestors that occasionally went on land from those that did not. And then draw a series of sketches illustrating the changes in the mother and the young one in connexion with the adaptation to suckling the young under water, co-relating these with the series of skeletons and musculature. Finally, try to prove that these intermediaries could in every case hold their own in competition with other animals.

Evolution, as I have already said, is accepted, not because of the scientific evidence but because special creation is regarded as "clearly incredible." You have made no real attempt, by the way, to answer that point, and to explain why either you or Professor Watson regard special creation as "clearly incredible." You have made no attempt because neither you nor Professor Watson can produce a single scientific fact which tells against the possibility that God might create two closely allied types. You reject this possibility because you have a funny feeling inside which tells you that a horse or a bird could not possibly have emerged from nothing on to the surface of this planet. But this funny internal feeling, which I have elsewhere described as "Fif," is not, as you suppose, an infallible guide. I

admit that my own Fif strongly biases me in favour of Evolution, a theory which is far more aesthetically attractive than the theory of special creation. But Fif, as we Catholics know, must be severely controlled by objective reason. Does it not strike you as a little strange that an atheist should, in effect, base his belief in Evolution on a purely fifish conviction that the God in whom he does not believe could not possibly be such a cheat as to create *ex nihilo* two different types whose anatomical relationship strongly suggests a common ancestor?

I don't in the least object to Evolution being treated as a useful working hypothesis, but in the name of science I protest against the unscientific confusion of the possible and the certain.

LOURDES

The quotation from Zola is from his novel. The novel, which is referred to elsewhere in the pamphlet, is a good example of Zola's photographic realism up to the point where realism fitted in with his views. His account is very close to the contemporary account of the Medical Bureau. But it is, as Father Woodlock says, incomplete. Incidentally, you know, of course, Zola in his book on Lourdes in describing the original of "La Grivotte" with whom he travelled to Lourdes, falsified the facts in his novel, and made her relapse and die, though he knew there had been no relapse.

His summary of Marie Lemarchand's case should be compared with Father Woodlock's quite brief description. It seems clear that in addition to the lupus of the face, which had been secondarily infected and secreted pus, there was evidence of pulmonary tuberculosis.

Now for the case of Madame Biré, which was not one of the cases put forward by me, but which you have criticized, and of which, accordingly, I had better reproduce the brief summary in the Lourdes pamphlet:

"*Mme Bire.*—There have been many instances of the cure of blindness. Mme Biré arrived at Lourdes completely blind from atrophy of the optic nerves due to some

cerebral cause. The blindness had lasted six months. This was certified by her doctor, Dr. Hibert of Luéon. She received back her sight suddenly at Lourdes as the Blessed Sacrament was being carried by after the procession. She was at once taken to the Medical Bureau and was found able to read easily the smallest print. As the examination was proceeding, Dr. Lainey, a Rouen specialist in eye diseases, entered the Bureau and at once was asked to examine her eyes. He did so, and on returning from the inspection declared that the case was quite straightforward —that the woman evidently had atrophy of the optic nerves and was stone blind, the fundus in each case being pearly white and the blood-vessels filiform and hardly traceable. 'But she can read!' said the President; and she read easily as before Dr. Lainey's entrance. It was true. The function had been given back before the organ had returned to its normal condition. It was nearly a month before the appearance of the optic nerve was certified as normal. 'It seems,' said Dr. Cox, who gave the writer these details, 'as though the Almighty were having a little joke with us medical men.' The full account of the case, with the certificates of Dr. Hibert and Dr. Lainey, is given in Dr. Boissarie's *Guerisons*."

You tell me that 10 per cent of blindness due to optic atrophy recover. Unless you can produce evidence of sudden recoveries, as was the case with Madame Biré, you have not disposed of this miracle. A sudden recovery may be miraculous where a recovery extending over several months might be due to natural causes.

Nor do I think you have made out any case against Dr. Lainey with the help of your quotation from Bell. All that Bell says is that in these cases the disc never recovers its normal appearance. Dr. Lainey, an eye specialist, was suddenly called in by the Medical Bureau to examine the eyes of a woman who had come to Lourdes to be cured of blindness. The fact that the woman had been cured was withheld from Dr. Lainey. He was not informed that she could read. He examined her, and as the eye had not recovered its normal appearance, and indeed still presented all the symptoms associated with this form of blindness, he

diagnosed blindness. Your quotation from Bell, so far from proving that he is a bad diagnostician, proves the very reverse. The facts at his disposal are (*a*) that the woman was blind when she came to Lourdes, (*b*) that sudden cures are unknown, and (*c*) that the appearance of her eye confirmed the fact that she was suffering from blindness due to optic atrophy on her arrival at Lourdes.

It was not his job to take miracles into consideration, and, apart from miracles, he made the only possible diagnosis on the facts before him.

I quite agree that the subsequent history of this eye does not entirely tally with Bell's view of what should happen in the rare cases of cure. But why should it? Text-books do not usually describe the results which follow miraculous cures. I do not think you are entitled to attack Drs. Lainey, Hibert, and Boissarie merely because they describe matters which do not fit in with your own knowledge of optic atrophy.

I am not surprised that you fall back on the only possible alternative to the acceptance of a miraculous cure, an attack upon doctors. Dr. Lainey, at least, had every opportunity of mastering the facts of optic atrophy. Before settling in Rouen he had been for three years clinical assistant to Dr. Panas of Paris, and, after him, for a slightly longer time with Dr. de Wecker. Both these men were extremely well-known Parisian oculists. It must be remembered that Dr. Lainey was not the only medical man to examine the disc.

You say that you are not likely to be converted unless I can produce miracles which violate the laws which apply to all physiological phenomena investigated in the laboratory. There are an overwhelming number of such cases recorded in the annals of Lourdes. I will confine myself to those mentioned in the little pamphlet which I have sent to you. Surely there is a violation of physiological law when a large and hideous ulcer heals up in a few minutes, as was the case with Joachine Dehant, or when the six fistulae, through which the entire waste products of Marie Borel's body had passed for five months without any natural movement through the bowel, closed firmly in

twenty-four hours, with the result that a few hours later motions passed normally. These seem to be cures which fulfil your test.

Mr. Alexis Carrel of the Rockefeller Institute for Medical Research, a scientist of some distinction, writes: "Certain facts observed in Lourdes cannot be accounted for by any of the known laws of wound healing and tissue regeneration. In the course of a miraculous cure, the rate of tissue construction greatly exceeds that which has ever been observed in the healing of a wound under optimum conditions."

You suggest that if I were to spend a year handling fossils I should be converted to Evolution. I think if you were to spend a few weeks at Lourdes, if you were to read, not only the little pamphlet which I sent you, but the bigger books on this subject, you would be converted to my view.

My argument rests not only on individual cases, which are as near coercive as evidence can be, but on the cumulative effect of a whole series of cases vastly more impressive than any similar cases recorded in the annals of Christian Science or of other faith-healing sects.

Let me now pass from your criticisms of particular miracles to discuss the argument against miracles in general, the argument which, for some odd reason of your own, you label "historical."

If phenomena may be divided into those which are due to supernatural agencies and those which can be explained by natural causes, what should we expect to find? We should expect to make occasional mistakes in classifying borderline phenomena, and we should expect primitive peoples to classify as supernatural many things which a more scientific age would assign to natural causes.

But for the life of me I cannot see why the very developments which are inevitable if the supernatural be a reality are solemnly trotted out as a "historical argument" against the supernatural.

The "historic" argument, stripped of unnecessary details, boils down to this: If A is true B must happen. But B happened, therefore A is untrue. Again, I cannot allow you to describe as "historical" an argument which draws no clear distinction between the reactions of savages and the

thinkers of the Middle Ages. You do know something about the Middle Ages, and you will, I hope, be prepared to agree that the leading thinkers of mediaeval Paris were as acute, as intelligent, and no more credulous than the leading thinkers of modern Bloomsbury. It has been well said that there was never a time when the average Londoner believed more things on authority than he does to-day. Indeed, the main difference between the man in the modern and the man in the mediaeval street is that the former accepts Darwinism on authority, and is wrong, and the latter accepted the evidence for the supernatural, and was right.

It is a travesty of the facts to suggest that our mediaeval ancestors lived in a constant state of expectation so far as miracles were concerned. It is a common illusion among pious people that miracles were much more frequent in past ages than in their own. St. Gregory, for instance, writing within six centuries of the Crucifixion, raises this same complaint, and looks back with much the same regret to the Apostolic Age. The mediaeval astronomer no more believed that the planets were guided round by angels than you do. The mediaeval physician no more believed that all diseases could be explained by evil spirits than you do.

Incidentally, a mediaeval philosopher would have made very short work of the well-worn but dreadfully superficial analogy between miracles and wireless.

The theory that we have ceased to believe in miracles because we believe in science is arrant nonsense. The mediaeval man, as Father Knox points out, believed in miracles precisely because he believed in science. Only those who accept the scientific belief in the uniformity of nature are in a position to recognize a miracle when they see one. It is, again, completely unhistorical to suggest that until comparatively recently a vast mass of phenomena of which modern science has discovered the cause has been attributed to supernatural agencies. Many phenomena which we now understand appeared inexplicable to our mediaeval ancestors, but it is absurd to suggest that they attributed to supernatural agencies all phenomena which they could not understand. Even if you could show that

they exaggerated the influence of the supernatural, this would no more prove that the supernatural is an illusion than the fact that the Darwinians grossly exaggerated the effects of Natural Selection would prove that Natural Selection is an illusion.

Finally, I dissent from your view that the process of transferring phenomena from one class to the other, from the supernatural to the natural, for instance, has been a one-way process. Far from it. Belief in the supernatural probably reached its lowest ebb in the middle of the eighteenth century. Somebody quoted the other day—I cannot put my finger on the reference—the despairing confession of a French aristocrat just before the Revolution: "There are scarce ten men in Paris who believe in God." In those days enlightened thinkers had every excuse for believing that the Catholic Church would disappear within the century, to be replaced by the new religion of Humanitarianism which they professed. They would have been bitterly disappointed if you had told them that there would be five times as many Benedictine monks in 1934 as at the end of the eighteenth century. A hundred years ago all non-Catholics assumed with complete confidence that miracles had ceased, if miracles had ever occurred. Had someone mentioned some well-attested case of a saint being lifted up in the air in a state of ecstasy he would have been met by the contemptuous rejoinder, "Hallucination or trickery." But to-day, as Father Knox remarks, you would probably be met by a very different answer. "Oh, *that*, yes, just levitation. Of course quite a recognized phenomenon when the subject is in a state of trance. You will find several cases on record if you consult the Psychical Research Society."

Materialism represented the climax of the process which you have been describing, the process of transferring events from the supernatural to the natural category. Materialism, in effect, attempted to break down the barrier between these two categories, and to explain all phenomena, mental no less then physical, by physico-chemical causes. Now, whatever may be the case with mediaevalism, materialism is dying, if not dead. Among modern scientists the tendency

is to reverse the process to which you refer, and to retransfer to the supernatural class many phenomena which foolish Victorian atheists attempted to explain by natural causes. There is an increasing tendency to admit all sorts of facts which were denied a hundred years ago, facts such as hypnotism, which may be broadly classified as psychic. Telepathy, which few scientists admitted fifty years ago is, I think, admitted by most scientists to-day. If I were prepared to imitate your cheerful habit of appealing to the future in support of my views I should insist that ectoplasm will be accepted to-morrow, and that within a few years all scientists that count will accept not only the phenomena of psychical research and the miracles at Lourdes, but the Catholic explanation of those phenomena and of those miracles.

I will, however, content myself with stating that modern science, with its technique of investigation, has vastly strengthened the case for the miraculous. It would have been far easier for a mediaeval Haldane to assert that some alleged miracle had not been adequately tested than it is for the modern Haldane. The technique of testing miracles has been developed at Lourdes no less than in the national laboratories of psychical research. Consequently, if it was easy for a man to believe in the supernatural in 1200, it is almost impossible for him not to believe in the supernatural to-day. The Bureau des Constatations at Lourdes, for instance has been in existence for over fifty years. Hundreds of miracles have been examined. If your theory was correct a large proportion of these alleged miracles would already have been transferred from the supernatural to the natural class, for the advance in medical science has been very striking during these fifty years. This, however, is not the case.

There has been no steady transference of phenomena from one class to the other. Science is as impotent to-day as it ever was to explain miracles which have occurred in every century and in every country. Science is as powerless to-day as it ever was to explain the evolution of life from lifeless matter, the evolution of mind, the vast array of religious phenomena, or the miracles which we accept as

such on evidence vastly stronger than anything which you have so far produced to justify your faith in Evolution. A few borderline phenomena may have been transferred from the supernatural to the natural class, but the vast mass of phenomena, originally classified as supernatural in origin, still remain obstinately inexplicable by science.

Your argument against miracles has, however, one obvious advantage: it can never be refuted. If a modern saint, after being guillotined in the streets of Paris, walked down the boulevards carrying his head in his hands, you would still be able to reply that the science of the future would one day be able to provide a purely natural explanation for an apparently supernatural event.

As to my definition of a miracle, I chose my words with care. Since we are arguing the general case of the supernatural versus atheism, I selected a definition which could be accepted not only by Catholics but by spiritualists or theosophists, or indeed by any reader who accepts the supernatural. *The Simple Catholic Dictionary* defines a miracle as "an effect above human or natural power," a definition which would certainly cover miracles worked by low-grade or evil spirits. On the other hand, St. Thomas Aquinas would probably not have classed the latter as miracles, as he defines a miracle as being outside the range of the whole of created nature (*præter ordinem totius naturæ creatæ*). I did not want to inflict on you niceties of Catholic doctrine, or of our belief that miracles at Lourdes are wrought not by the Madonna directly but by God on the intercession of the Madonna.

My definition covers miracles worked by God, who is a spirit, and miracles worked by evil spirits. Your attempt to prove me wrong with the aid of St. Thomas would be impressive if every spirit were an angel. But as this is not the case, I leave you to hunt for your own undistributed middles. You may remember that you very kindly offered to teach me logic in the course of this correspondence.

I knew you would try to saddle me with a view which I am not prepared to defend—the thesis that all miracles outside the Church are the work of evil or low-grade spirits. Unlike you, I have no Fif to guide me on this problem or on

Evolution, and I feel that Father Knox strikes the true note of Catholic agnosticism when he writes: "I do not even feel certain that a miracle might not be done to attest the message of some Salvation Army missionary to China while he was preaching all the faith he knew to people who had no chance of hearing about the faith from Catholic teachers."

Your reason for considering it enlightened to disbelieve in evil spirits is a good example of the fact that hatred of Catholic conclusions normally prevents anti-Catholics from ever examining Catholic premises. You consider it unenlightened to believe in witches because you believe, as I do, that it is unenlightened to burn witches. By parity of reasoning a capitalist could prove that it is unenlightened to disbelieve in capitalism because it is unenlightened to torture and kill capitalists. The fear of witches was responsible for much cruelty. So was the fear of spies in the war. But it is not "enlightened" to disbelieve in the existence of spies.

Meanwhile, may I register an indignant protest against your suggestion that if witchcraft could be proved to be true there would be "a very good case" for burning or torturing old women condemned as witches. Witch-harrying is, of course, one of the oldest, most widespread and most persistent of human activities, and is not, as the reader might infer from your remarks, an activity invented by the Catholic Church.

I do not regard your sanctimonious remarks on the subject of your Hindu friends, and how much you would dislike executing them, as fair controversy. If you wish to suggest that modern Catholics favour the reintroduction of the death penalty for heresy, a proposition as difficult to maintain as the theory that modern Englishmen favour the reintroduction of hanging people for petty theft, you should not try to prejudge our case in a sneer which can be conveyed in a single sentence, but which would require many pages adequately to discuss. Incidentally, your remark is silly, because, as you know, the Catholic Church only claims jurisdiction over baptized Christians, and therefore never claims jurisdiction over Hindus.

I wish that you would be a little more precise on the period of history when astronomers explained the movements

of stars as the guidance of angels. But let us assume that this was a generally accepted explanation. I should argue as follows:

We should never accept a supernatural explanation of an event without adequate evidence. We should not accept a supernatural explanation if a plausible explanation can be found. There is no evidence whatever for the angelic theory of planetary movement, and there is therefore no reason whatever to reject the scientific explanation of planetary movement which is supported by abundant evidence. In brief, we reject the angelic theory of planetary motion for exactly the same reason as we reject spontaneous generation. The angelic theory and spontaneous generation may fit all the facts, but there is no more evidence for the latter than for the former theory.

I shall not in this letter discuss your further quotation from St. Thomas, because the strength of your argument rests on a fundamental misconception of his philosophy, as I shall try to show in my subsequent letter.

I do not know whether you mean to imply that Lord Kelvin's view on the age of the sun was adversely influenced by his piety, but when you use a phrase such as "a pious scientist" I suspect that the depreciatory adjective is intended to discount the respect which you would otherwise claim for the august substantive. I suppose you would concede that Kelvin's intelligence was equal to your own, and his position in the world of science considerably greater. Therefore if Lord Kelvin was fallible on scientific questions, you may be fallible. If Kelvin went wrong on the age of the sun, you may be equally mistaken on the age of the earth. The regularity with which the scientific beliefs of one generation are rejected by scientists of the next generation has very little bearing on the question of their theological beliefs. What bearing it has might be used with equal plausibility to discredit the atheism of a Haldane or the theism of a Kelvin.

Horace Walpole had no more reason than we have for a sceptical attitude to the scientific fashions of the moment. "In my youth," he wrote, "philosophers were eager to ascribe every uncommon discovery to the deluge; now it is

the fashion to solve every appearance by conflagrations. . . . I am a great sceptic about human reasonings; they predominate only for a time like other moral fashions, and are so often exploded after the mode is passed that I hold them little serious, though they called themselves wisdom. How many have I lived to see established and confuted!"

But though it is only scientific to adopt an attitude of suspicion and reserve to the scientific fad or fashion of the moment, to Lord Kelvin's views on the age of the sun or your views on the age of the earth, it is not unreasonable to be impressed by one theory which has been consistently held through changing fashions by an overwhelming majority of the great scientists of all ages, the theory that creation implies a creator.

The evidence in support of this thesis requires a letter to itself.

Yours sincerely,
ARNOLD LUNN.

XXVI.

EVIDENCE OF DESIGN

2 Albany Courtyard,
Piccadilly, London, W.1.
May 23, 1934.

My dear Haldane,

I am, as I have said, an agnostic on the general question of Evolution, but I am far from agnostic on the question as to whether Evolution, if it has occurred, can be explained by chance, a phrase which I use as a convenient abbreviation for "the product of chemico-physical forces unguided by intelligence." And I shall try to show in this letter that the facts point irresistibly to the conclusion that the process has been guided by supernatural intelligence.

If I were to show you an inanimate object, and to ask you whether, in your opinion, the object owed its form to intelligent shaping, that is, to design, or to chance, you would examine the object in order to discover whether it possessed any or all of the three sign-marks of intelligent design, which are pattern, co-ordinated movements, and intelligent achievement.

I hand you a stone. If this stone is unsymmetrical and without pattern, you return it to me with the remark that the stone has at some time in the past broken away from a cliff, but if the stone is cut in a certain fashion and worked in a certain manner, you might classify it as a primitive tool or arrow-head.

Again, let us suppose that you had never seen a watch, and that you found on some heath a wheel which had become detached from a watch. You would be impressed by the regular pattern, and suspect human workmanship, but, remembering that a crystal also possesses a regular pattern, you might remain unconvinced. If, however, you discovered a complete watch you would be bound to believe that the watch had been designed. A watch possesses the three sign-marks of design, regular pattern, accurate co-ordination of the different movements of wheels and springs, and intelligent achievement, for the result of this

co-ordination is to provide an accurate record of the passing of time.

This argument, which is commonly attributed to Paley, was first advanced by Voltaire, who writes as follows: "If a clock proves the existence of a clock-maker, and the world does not prove the existence of a supreme architect, I consent to be called 'cause finalier,' that is to say, a fool."

You have, in the course of this correspondence, professed yourself to be a "humble disciple" of Voltaire. It may interest you to learn that your master condemned as "the most revolting stupidity" the very theory which you seem prepared to defend, the theory that there is no evidence for intelligent design in nature. "Sceptical as I am," wrote Voltaire of this theory, "I declare such to be evident madness."

The sign-marks of design are manifest not only in living forms but even in inanimate nature. Consider, for instance, the atom. I am no physicist and no chemist, and you will, I hope, read what follows not as a dogmatic utterance, but as a statement put forward for your comment, for I am quite prepared to accept correction on matters within your province.

I wonder whether you would dispute the statement that an atom is not only a more complicated but a more accurate piece of mechanism than a watch? Round the central nucleus flash the electrons at a speed of seven million revolutions to the second, and yet so accurately do they run to time that they neither lose nor gain a millionth part of a second in millions of years. Here you have two at least of the sign-marks of design, regular pattern and co-ordinated movements, even if the third sign-mark, intelligent achievement, is open to dispute. Consider again the fact that these billions of atoms are divided into ninety-two different kinds, and that each specimen is made to specification. The atheist must believe the atomless ether blindly evolved some kind of manufacturing machinery, competent, as Macfie remarks, to standardize and turn out these beautiful contrivances. How can the evolution of the atom, a miniature solar system, be explained on Darwinian lines? Are we to suppose that atoms evolved from simpler beginnings under

the influences of natural selection? Surely it is as impossible, as Macfie says, "to believe that an atom was made by bits as to imagine a bubble or a living cell made by bits."

These "kinetic miracles" are as urgent in their demand for supernatural explanation as the miracle of the first living cell.

You will, I am sure, agree that the odds are billions to one against the intricate co-ordination and co-operation of chemical compounds which is the necessary prerequisite for the appearance of life on this planet. And even if you are prepared to believe that the necessary conditions are the product of pure chance, you have still to explain the origin of life, for the existence of an environment capable of supporting life is not a compelling reason for life to appear. It is, I suppose, agreed between us that there was no life on the surface of our planet when the planet first separated itself from the sun. Consequently life must have had an absolute beginning at some definite point in time. Now, spontaneous generation has never been observed, and if it be true, as Tyndall said, that "men of science prolong the method of Nature from the present into the past" and that "the observed uniformity of Nature is their only guide," it is difficult to understand what is your justification for believing in spontaneous generation. If we prolong the present into the past we have no warrant for assuming that something for which the world as we know it provides no explanation happened in the past. Of course spontaneous generation is *de fide* for the atheist, but in this, as in other matters, the "observed uniformity of Nature" tells against the atheistic hypothesis.

In a recent advertisement of a popular scientific work I read that "in the primeval ocean, Life pulsated for the first time as a tiny single cell." This "tiny" cell recalls the classic defence of the illegitimate child, "It was such a little one." It is, however, as you will be the first to admit, only the untrained imagination which equates the "tiny" with the "simple."

The simplest cell known to science is a marvellous and intricate mechanism. It differs from non-living matter by its power of assimilating nourishment, by its power of

independent motion, and by its power of passing on the torch of life to its descendants. The process of cell division, which is the cell's method of reproduction, is, as you know, a process of infinitely delicate adjustment. The nucleus of the cell contains a number of thin threads called chromosomes. These are split lengthways, and divided into two equal portions. Each of the two cells into which the parent cell divides requires an exactly equal number of chromosomes. The allocation of chromosomes is carried through with unerring accuracy and discrimination. Pure chance?

No chemist has ever succeeded in reproducing in his laboratory a living cell, however simple. Is it conceivable that blind chance could succeed where the directing skill of the chemist has failed? As that great scientist, Sir William Tilden, remarked, "No known or conceivable process or groups of processes at work in organic nature is equal to this task. Chance is an explanation only for minds insensible to the beauty and order of organic life."

"Insensible to beauty." Yes. It is the Philistine who has said in his heart "There is no God."

Darwin evaded this issue, as indeed he evaded all the difficulties of his theory. He was prepared to concede that the Creator may have breathed life into the primary forms from which all living things are descended, after which, he gave us vaguely to understand, each primary form was told that it could expect no further assistance from God, and must make its own upward way in the world by its own unaided exertions. But those disciples of Darwin who had discarded God quietly assumed that it was sufficient for Darwin to allude to "The Origin of Species" in his title, and nobody would be such a cad as to expect the Darwinist to explain the real origin of species, the appearance of the first living cell. By an ingenious trick of terminology the reader was induced to believe that an alleged explanation of the *transformation* of species was, in effect, a genuine explanation of the *origin* of species.

The fact is, that the emergence of life from lifeless matter, if it occurred, destroys the basis of Darwinism, the belief that evolution can be explained by the survival of the fittest. "Professor Whitehead," writes Mr. Sullivan, "points

out that the doctrine of organic evolution does not in the least explain why the process should have ever occurred. The phrase 'the survival of the fittest' offers no explanation, for life itself has very little survival value in comparison with the inorganic matter from which it sprang. A rock survives for hundreds of millions of years, whereas even a tree lasts only a thousand years. If 'survival' was what Nature aimed at, why should life appear at all? Again, why should the trend of evolution be upward, so that higher and higher types are evolved? The doctrine of evolution does not explain this. The upward trend cannot be due to the influence of the environment, for the lower types are just as well adapted to *their* environment as are the higher types."

In other words, the bacterium is just as "fit to survive" as a baby.

Elsewhere[1] you inform us that "Consciousness arises anew in every human being. Its first origin on the earth presents no less mystery than its last." Surely it would not help *your* case if you could show that it is as difficult to suggest a non-supernatural explanation for the dawn of consciousness in the individual as for the dawn of consciousness on this planet. The theist might indeed be tempted to concede a point which strengthens his case and which weakens yours, but actually it is incorrect to imply that the observed continuity of life is a less serious difficulty for the atheist than the emergence of life from lifeless matter. If "the observed uniformity of Nature" be our only guide, then we must accept, at least as a working hypothesis, the universal application of the principle *omne vivum a vivo*. And if this principle holds good throughout the sphere of the natural, then clearly a supernatural creative act must be postulated to explain the origin of life on this planet.

I envy you people your power of Faith. Faith is a wonderful gift. I do wish that I could believe in things just because I wanted to believe in them. Faith without facts is *so* impressive. I wish you would let me into the secret. It must be so nice to believe in spontaneous generation just

[1] *Possible Worlds*, p. 44.

because spontaneous generation is the rock on which the simple impiety of the godless is built. It must be jolly to feel so certain that something *must* have happened for which there is no evidence whatever. It must be nice to be able to accept Tyndall's principle of uniformity one moment and discard it the next. "The guide to the world of the past," writes Sir Arthur Keith, "is the world of the present." It must be grand to be able to write like that, and yet have no difficulty in believing in an event which, if it happened in the world of the past, ought to be—but is not—happening in the world of the present.

Christian rationalism is so dull compared to Atheistic Faith. It is such a bore being hampered at every turn by historic documents. Prehistory gives such scope compared to history. And, of course, we can't hope to compete against people who can assume the existence of any document which is necessary to complete their case, whose creed is securely anchored to incidents for which there is no record in the past, to links which continue to be missing, and to a geological record whose very imperfection has been triumphantly cited by Wallace (see below) as evidence in support of his own theory of what the record would have looked like if complete. Isn't it sickening that Christians are not allowed to appeal to the unwitnessed miracles of Christ or to the imperfection of the Gospel record as evidence in support of his unrecorded sayings?

But I must not say one harsh word about the Faith which assumes that the past has provided, and that the future will provide, all the incidents and evidence necessary to support an incredible creed. Faith, as St. Paul remarked, is the substance of fossils hoped for, the evidence of links unseen.

It is so much simpler to assume the conclusion which it is our business to prove and then to show triumphantly that the hypothesis of spontaneous generation is "in harmony with the general trend of the evolutionary theory," to quote from the late Sir J. Arthur Thomson. By a similar process of reasoning that eminent scientist, A. R. Wallace, gravely remarked that the non-discovery of the missing links was "one of the strongest proofs of the geological

record." Why is the record imperfect? Because the links are missing. Why are the links missing? because the record is imperfect.

All that is needed to salvage mindless evolution from shipwreck is to supplement the theory of spontaneous generation as an explanation of existing forms, with the theory of spontaneous degeneration as the explanation of the missing links.

The origin of sex is as baffling a problem as the origin of life. If survival was what Nature aimed at, the sexless method of reproduction, which is as efficient as the sexual, would have served her purpose. And I think that the protozoa who have continued to reproduce themselves by the well-tried, if old-fashioned, methods of sexless division have no reason to regret their conservatism. "Our family," I can imagine one of them remarking, "have always said that no good would come of these newfangled methods of carrying on the race. We get the same results as you do without all these horrid scandals." To which, I suppose, the bright young metazoa would retort that "these old protozoa have technique but no imagination."

We see the beginnings of sex in certain microscopic single-cell animals and plants. It begins as an intrusive process. The simplest flagellates, for instance, are old-fashioned individuals who still continue to multiply by sexless cell division (binary fission), just as bacteria do, though at times the charming home life of these little creatures is complicated by romance. "Occasionally," an eminent scientist assures us, "if we are watching the creatures through a microscope, two individuals may be seen to come together and to melt completely into one." Now I call that sweet.

I do wish you would provide a Darwinian interpretation of this love idyll of the flagellates. How did this bad business begin? How would you reconstruct the scene? A spring morning, I suppose, on the shores of some palaeozoic sea. A flagellate, more emotional than his mates, suddenly becomes conscious of a new and disturbing sensation when he meets another flagellate, who has just a little something which the others haven't got. He feels very queer, a Darwinian mutation which mutates him all over.

Suddenly the flagellate who has provoked these emotions begins to reproduce her species in the good old-fashioned way by dividing into two, rending her chromosome garments in twain. "Not that, not that," exclaims Flagellate No. 1, "rend your heart and not your garments." And so, for the first time in evolutionary history romance conquers routine.

Is sexual passion a mutation? And if so, has it more survival value than sexless reproduction? Do your equations throw any light on the matter? Do you really suppose the intensely complicated psychical disturbances involved in sexual reproduction can be explained by the natural selection of a mutation, itself the product of mindless, mechanical chemical sources?

The truth is that the neo-Darwinist attempt to explain Evolution by the Natural Selection of favourable mutations will not stand the strain of any changes more radical than the trivial variations of minor evolution. Mutations can build no bridge across those great ragged gaps in the geological record which are such a ghastly difficulty for the evolutionist.

It is difficult to believe that radical transformations, such as the transformation of creatures without shells to creatures with shells, or of creatures that emerge from an egg to creatures that emerge from the womb, could have been brought about by the accumulation of fortuitous mutations. Minor changes, perhaps. The evolution of the three toes of a horse into a hoof may be tolerant of some such explanation, but, as Macfie says, "We can hardly imagine a shelled egg *gradually* giving up its shell, and its food supply, and *gradually* making a placental connexion, blood-vessels and all, with the parental uterus. It is one of these variations which—if it occurred in the course of reproduction—must have been sudden and complete in all its complex correlation." Once we are forced to postulate vast complex mutations, leaps not of a single character but of battalions and guilds of characters, mutations involving elimination and reconstruction on a stupendous scale, we might as well admit special creation and have done with it. For is it much more difficult to believe in a deity who evolves a

bird out of nothing than in a deity who evolves a bird, by a sudden mutation, out of a lizard?

A human surgeon produces mutations in the body when he removes an appendix or grafts new tissue, but, as Macfie points out, the greatest surgical skill is needed to mutate without mutilating. It is almost as inconceivable that pure chance should produce one of these complex and valuable mutations as that a village idiot could perform a complicated major operation.

I wish that I had space adequately to present the innumerable problems which Darwinism cannot begin to solve, the phenomena of regeneration, for instance. Cells are capable not only of repairing routine injuries by routine methods but of coping with sudden emergencies in new and original ways. Whence do they obtain their prescient versatility? And I defy you to explain the transformation of a caterpillar into a butterfly as the product of purely mechanical evolution.

Finally we come to the human eye. Darwin confesses that there was a time when the thought of the eye made him feel cold all over. He got over that stage of the complaint by his favourite device of burking the fundamental difficulties of his theory. He played the "it does not concern us" card. "How a nerve comes to be sensitive to light hardly concerns us more than how life originated." In other words, two fundamental problems of evolution do not "concern us." He might as well have written, "How a reptile turns into a bird hardly concerns us more than how an ape turns into a man."

Astronomers, I suppose, know as much as most people about lenses, and it is therefore interesting to note the reactions of a Savilian professor of astronomy to the absurd hypothesis that an optical instrument such as the eye could be improved by mere accident. Here is the quotation which I borrow from Mr. Noyes' excellent book *The Unknown God*:

"Suppose, for instance, one of the surfaces of the crystalline lens of the eye to be accidentally altered, then I say that unless the form of the other surface is *simultaneously* altered in one only way out of millions of possible ways, the eye

would not be optically improved. An alteration in the two surfaces of the crystalline lens, whether accidental or otherwise, would involve a definite alteration in the form of the cornea, or in the distance of its surface from the centre of the crystalline lens, in order that the eye may be optically better. All these alterations must be simultaneous and definite in amount, and these definite amounts must coexist in obedience to an extremely complicated law.

"To my apprehension then that so complicated an instrument as the eye should undergo a succession of millions of *improvements*, by means of a succession of millions of accidental alterations, is not less improbable than if all the letters in *The Origin of Species* were placed in a box and on being shaken and poured out millions and millions of times should at last come out together in the order in which they occur in that fascinating and, in general, highly philosophical work.

"All this suiting of the succession of circumstances is to go on, not once or twice, but millions on millions of times. If this be so, then not only must there be a Bias in the order of the succession of the circumstances, but so strong a Bias as to remove the whole process from the accidental to the intentional. The Bias implies the existence of a Law, a Mind, a Will. The process becomes one, not of Natural Selection, but of selection by an Intelligent Will."

In other words, it is absurd to suppose that an accumulation of fortuitous mutations could produce a result which requires the simultaneous occurrence of accurately co-ordinated alterations.

The eye is the most intricate of machines, and, even if the eye could be explained by pure chance, you would still have to explain the infinite complexity of the arrangements whereby the eye is co-ordinated to the remainder of the body.

And even then you would only be at the beginning of your trouble, for you would have to invoke an equally miraculous series of amazingly fortunate coincidences to explain the ear, the lungs, the digestive system, etc.

And that would not be all. For the long arm of coincidence would have to remain on the rack while you stretched it still farther to account, by pure chance, for the

co-operation of the various organs in that astoundingly intricate machine, the human body, a machine which possesses all the sign-marks of design, pattern, accurate co-ordination of movement, and intelligent achievement.

No wonder you people are trying to prove that the earth is much older than Darwin ever imagined. You would need infinite time—and then some—to evolve by pure chance an eye, let alone the body of man.

And even if the physical framework of life could be explained by purely mechanical causes, you would not have begun to explain the empire of man's mind.

All these attempts to explain life by mechanico-physical causes are as sterile as would be the effort to explain Fra Angelico's *Crucifixion* by a chemical analysis of the canvas, colouring and brush.

Even atheists are beginning to wonder whether the selective action of a mindless environment can really explain the transformation of a blob of colloid in the course of ages into the mind that produced "Hamlet." I seem to detect evidence of a wistful search for secondary causes to assist environment in its task. A Lamarckian, like Samuel Butler, might conceivably evoke the intelligent co-operation of the living creature with its environment as a factor in the evolutionary process, but the fundamental problem admits of no such solution. God or the blind action of mindless environment are the only two explanations of the evolution of the first living cell.

Atheists again must believe that the world as we know it was potentially present in the cosmic vapour from which our solar system was born. Professor Tyndall was not usually regarded in his day as a prop of theism, but this final absurdity was too much for him. "Strip it naked," he wrote of this theory, "and you stand face to face with the notion that not only the more ignoble forms of animalcular or animal life, not only the nobler forms of the horse and lion, not only the exquisite and wonderful mechanism of the human body, but that the human mind itself, emotion, intellect, will and all their phenomena—were once latent in a fiery cloud. Surely the mere statement of such a notion is more than a refutation."

What is the only alternative? The theistic hypothesis which you reject. Voltaire and Tyndall unite, as you see, in dismissing your beliefs, if they really are your beliefs, as "evident madness." I am impressed not by the scepticism but by the credulity of our atheists. The faith which moves mountains is feeble indeed compared with the faith which mutates mud into man.

Your theory, I suppose, is that the first primeval seas spawned the first fortuitous blob of colloid. Environment set to work, and by a series of happy inspired mutations produced from this parent cell all the existing varieties of life: moths and monkeys, trilobites and trees, sharks and Shakespeare. Is it really so much more difficult to believe in God than in an environment as fastidious as a professional wine-taster, as neat-fingered as the most skilled of surgeons? A foolish young man once went up to the Duke of Wellington at a public function and remarked inquiringly, "Good afternoon, sir. Mr. Smith, I believe?" "If you believe that," replied the Iron Duke, "you would believe anything." Much the same retort might be made to the evolutionary atheist.

Atheism indeed makes as few recruits among great scientists as among artists and poets. I have too much respect for your intelligence to believe that you are a dogmatic atheist, but as the reader of these letters may be misled by your criticisms of theism into the belief that atheism derives some support from science, I will conclude this long letter with a catena of quotations from eminent scientists all of whom agree with Voltaire in dismissing as "evident madness" the belief that the world in which we live is the product of blind chance and purely mechanical forces.

"This grand sequence of events the mind refuses to accept as the result of blind chance. The understanding revolts from such a conclusion" (*Charles Darwin*).

"Science positively affirms creative power which it compels us to accept as an article of faith" (*Lord Kelvin*).

"I believe that no rational man doubts the existence of an intelligence in the universe, even as no physicist denies the existence of magnetism. This being the case I do not understand why men do not make use of intelligence to

explain facts which certainly can be best explained through the activity of the intelligence" (*Professor Kronig* of Berlin).

"There is something that is the order of the cosmos and the beauty of the world, that lives in all things living and dwells in the mind and soul of man. . . . You may call it the Harmony of the World: you may call it the 'Élan Vital,' you may call it the Breath of Life. Or you may call it, as it is called in the Story Book of Creation and in the hearts of men—you may call it the Spirit of God" (*Professor d'Arcy Thompson*).

"The exquisite structure of the sun, the planets, and the comets could not have had their origin but by the plan and absolute dominion of an intelligent and powerful being" (*Newton*).

"In whatever direction we push our researches we discover everywhere the clearest proofs of a creative mind or of its providence, might and wisdom" (*Lyall*).

"The genuine scientist can never force his way into knowledge of the secrets of creation without being aware of the finger of God" (*R. Boyle*).

"I would more readily believe that a book on chemistry or botany could grow out of dead matter than believe that a leaf or a flower could be formed or could grow by chemical forces" (*Liebig*).

"It looks as if Nature were Nature for a purpose, and as we cannot predicate purpose in a vast system we must reverently ascribe it to a Creator" (*J. A. Thomson*).

"To suggest that this sustained, orderly, pulsating, rhythmical way, in which things on the whole progressively advance, is all a haphazard affair makes a greater demand on our credulity than the most liberal acceptance of an Old Testament miracle.

"In fact no explanation will ever satisfy the human reason that does not in some way make Mind the essence of the process" (*Professor T. Young Simpson*).

And finally let me conclude with a few quotations from a great scientist and a great philosopher. My extracts are from *The Philosophical Basis of Biology* by J. S. Haldane, F.R.S.

An "emergence of life out of a Newtonian world would be a quite unintelligible miracle" (page 39).

"The more we discover as to physiological activity and inheritance, the more difficult does it become to imagine any physical or chemical description which could in any way cover the facts as to persistent co-ordination. From the standpoint of the physical sciences the maintenance and reproduction of a living organ is nothing less than a standing miracle, and for the reason that co-ordinated maintenance of structure and activity is inconsistent with the physical conception of self-existent matter and energy" (page 12).

"Scientific thought does not involve physical realism" (page 130).

And finally:

"The existence of God must be the central feature in future developments of philosophy" (page 130).

Yours sincerely,

ARNOLD LUNN.

XXVII.

THE ARGUMENT FROM DESIGN

16 Park Village East.
Aug. 13, 1934.

Dear Lunn,

The perspicacious reader will have noticed a possibly significant difference between my attack on St. Thomas's theology, and your defence. I quote him at considerable length. You reply that my summary of his views is a travesty. Unless you are prepared to withdraw this statement which reflects on my intellectual honesty, I must request permission to print his proofs of the divine existence from the *Summa Theologica* as an appendix to this book. Our readers will then be able to judge for themselves. By the way, the *Acta Sanctorum* describes him as "grossus," i.e. fat. I think the altar story, which I quoted as a joke, is from Bracciolini, or some other humorist. But anyway I did not invent it.

You, on the other hand, quote exactly one sentence from St. Thomas, but many from Professor Taylor, Professor Tout, Dr. Patterson, Alfred Noyes, Professor Henderson, Professor Eddington, Mr. Chesterton, Sir James Jeans, and Pasteur. You also, as usual, insult me in a gratuitous manner by assuming that I have not read any elementary text of scholastic philosophy. I read Cardinal Mercier's text-book seventeen years ago.

Now St. Thomas made mistakes (e.g. his belief in astrology), but at least he made it fairly clear what he meant in most cases. He argued, starting from a body in motion, namely, the sun, that its motion must be due to a mover. Thence he argued back to an unmoved mover, or unchanged changer. His words, at least in the *Summa Theologica*, leave it open whether he thought that all the series of movers, from the sun to God, were acting simultaneously or successively. His argument is as valid in one case as in the other.

Hence I did not, in attacking it, make the assumption least favourable to him, namely, that he thought all the movers were simultaneous. I gave him the benefit of the

doubt, though quite aware that he inclined to the opinion of Aristotle, which, as I think, has been demolished by Newton. If, however, you think that in order to prove St. Thomas you must disprove Newton's view that a body in motion continues in motion unless something stops it, I shall be delighted to defend Newton.

My rebuttal of St. Thomas's argument does not, as you assert, rest on a confusion between the infinite divisibility of a continuous line and the possibility of an infinite number of changes in real entities (whatever that phrase may mean). I simply chose the points on a line as a familiar example of a series whose members have the same simple type of relationship (before and after, or predecessor and successor, if you prefer longer words) as a series of movers. Such a series may have a first and a last member, a first but no last, a last but no first; or, finally, neither a last nor a first.

Of course an infinite series does not help me to get rid of dependence. Why should it? I have never come across anything which did not depend on something else, and I don't expect to. It is surely up to you to prove that such a being exists. You assume it. I quite agree with Dr. Patterson that however long we trace causes back "we are no nearer reaching an ultimate and self-explanatory cause of motion." And however long we go on counting we do not get any nearer to a largest number, because there is no such thing. Why should there be? I have devoted some care to St. Thomas's arguments. They are at least a lot clearer than your summary. I think that there are universals, which are not in time, and thus not contingent, but I do not think that they are causes of events in time. If I add two matches to two others there are four, but "two and two makes four" did not move the matches. Similarly, happenings such as causal series are only intelligible by means of universals, but the universals are not members of the series.

Let us examine Professor Taylor's argument. He says that "our knowledge of any event in nature is not complete until we know the full reason for the event." Of course no knowledge is complete. Professor Taylor points out that it remains incomplete unless we can trace the causal chain back to something which is its own *raison d'être*—in other words,

to God. At this point, writes Professor Taylor, "your knowedge becomes complete." I take off my hat to the Illuminated Professor, who tells me how to obtain complete knowledge. St. Thomas, of course, never made any such extravagant claim, which is one of the many reasons why I prefer him to his interpreters, and think that they have done him less than justice. Some humble searchers after truth will consider that Professor Taylor's argument is sufficiently refuted by the claim that it leads to complete knowledge about any event. What a pity he did not tell the world all there was to be known about, say, the boiling of a kettle.

You say that you will not waste time over minor points. I do not think that what St. Thomas wrote is a minor point. He did not speak, like Professor Patterson, of an ultimate and self-explanatory source of motion. God is not self-explanatory, in my opinion. St. Thomas thought that, so far from this being the case, our knowledge of him was of an indirect and negative character. Dr. Paterson says that God is self-explanatory, Mr. Noyes that he is an absolute mystery. You can't have it both ways. Why not go back to what St. Thomas said?

I leave it to readers of St. Thomas's own words to judge whether or not I have misquoted his third argument.

I am not quite clear as to the mistake into which I have fallen as to the saint's fifth argument. You say that "we must accept St. Thomas's alternative, origin by design." And in the next sentence you say that I "make the mistake of confusing it with Paley's argument from design in nature." Where am I to look for evidence of design, except in nature? It is entirely untrue that all St. Thomas tried to prove was that all things are governed by mind (see Appendix). I submit that the phrase which you quote, "*consequuntur in quod est optimum*," or "lead to the best possible result," is an integral part of his argument. I repeat that parasites show just as much evidence of design for evil as food plants of design for good, and that your page of witticisms on the subject contains no attempt to explain away this perfectly overwhelming fact.

You point out that our planet (or, accurately, part of its surface) is favourable to life. True. But St. Thomas was

arguing that the whole creation was so. You quietly drop this argument, and confine yourself to one small portion of it, whether unique or not no one knows, almost certainly very exceptional. You say that God made it as a habitation for man, or else it originated as the result of a series of fantastic coincidences. What coincided fantastically with what? I should really like to know.

You quote Eddington's statement, "The picture of the world as drawn in existing physical theories shows arrangements of individual elements for which the odds are multi-million to one against an origin by chance." Eddington seems to be writing about the physical universe, not the planet Earth. I quite agree with him, but I never heard of anyone who suggested that the physical universe originated by chance, nor can I attach any meaning whatever to the phrase. It seems to me very likely that it did not originate at all, and it is up to you to prove that it did. When you have done so we can discuss how it originated. You say that "if we reject origin by chance, we must accept . . . origin by design." You seem to neglect the third possibility of no origin. If you were only writing about our planet, let me know what special features of it disprove its origin by what you call chance, and I call physical processes undirected by mind.

We are left with L. J. Henderson's argument, which amounts to this, that if the properties of certain substances were different we should not be here, and that for all we know at present they might have been different. This is a good argument as far as it goes, but it does not go very far. If the properties of matter were different in other respects there would be many more opportunities for life than there actually are. Henderson's argument may stand the test of time, or it may turn out, as we get to know more physics, that the remarkable properties of carbon, for example, would inevitably exist in some element in any universe which we could imagine.

I have not yet touched on the main argument against the hypothesis of a creator, as opposed to one or more organizers. We have no analogy whatever for creation, i.e. making out of nothing, in our experience. When I "make" a box, I

make it by rearranging bits of wood and iron. When God made the world He is alleged to have made it out of nothing. The word "make" is used in two different senses, one of which refers to something purely hypothetical, in a way that natural selection, for example, is not hypothetical, and spontaneous generation of life is. The hypothesis that life arose from inanimate matter would be as scientifically worthless as the hypothesis of creation out of nothing were it not for one simple fact. Given sufficient time, it should be perfectly possible to test the former theory by trying to make a living thing from non-living constituents.

As far as I can follow the various arguments which you substitute for St. Thomas's, they all seem to boil down to a longing for intellectual rest. Professor Taylor longs for complete knowledge, Mr. Noyes for an ultimate being, Dr. Patterson for a self-explanatory source of motion, you for an escape from thinking about infinity. The world as known to us is full of contradictions, as Plato pointed out. Things are at once large and small, in rest and in motion, alive and mechanical, good and bad, according to our point of view. Your solution is to take all these contradictions, or as many as you can, and "solve" them by the hypothesis of a being who is at once self-explanatory and utterly mysterious, out of time but everywhere in space, three yet one, and so on. No wonder such a being is incomprehensible. It is incomprehensible because it is self-contradictory.

The scientific method is to deal with these contradictions one at a time, as Newton, for example, dealt with the contradiction about rest and motion. In resolving a contradiction in this way we arrive at new knowledge about things. In evading it by postulating an incomprehensible being we do not.

You will perhaps reply that many scientific and mathematical concepts, for example "expanding space," are incomprehensible and self-contradictory. I take that as an extreme example of a phrase which I think should never have been coined. It does stand, however, for a group, or, accurately, a number of groups, of self-consistent equations for the motion of bodies. They lead to perfectly definite consequences which can be verified or shown to be false.

When, however, one attempts to use your self-contradictory God as a source of new predictions capable of verification or otherwise, you take refuge in such words as "mystery." That is why the hypothesis of God, at least in its Catholic form, is of no scientific value. So far from giving us complete knowledge about any event, as Professor Taylor states, it serves as an excuse for refusal to think by acting as a kind of dump for all the contradictions found in our experience. Evil is a mystery, exceptional events are miracles, and so on.

In the second part of your letter you produce a slightly new version of Paley's watch argument. You say that the sign-marks of intelligent design are pattern, co-ordinated movement, and intelligent achievement. I grant you the third. If intelligence is there it is there! I deny the first two. Look over a cliff at the sea. You see a beautiful, nearly regular pattern of waves. Moreover, they are only made possible by co-ordinated movement. The various water particles move in nearly circular orbits so co-ordinated as to give a wave pattern. I deny that this is a sign of intelligent design. If matter has any stable properties at all it must, under certain circumstances, form patterns and execute co-ordinated movements.

Your argument that atoms resemble manufactured articles was put forward, I think, by Balfour Stewart, in the nineteenth century, and disproved by Rutherford and his colleagues in the twentieth. Actually the atoms seem to be made up of quite few (perhaps only two) kinds of units, which arrange themselves in certain patterns of greater or less stability, like billiard-balls in a pile. Some of these patterns are very unstable, and we are only just discovering them as radioactive elements. The ordinary chemical elements are the stabler patterns left over by a process not unlike natural selection. Macfie finds it impossible to believe that an atom was made by bits. The physicists may be wrong in claiming to have built up heavier atoms from lighter. But before I disbelieve them I should like some better reason than that Macfie found it incredible.

I certainly dispute your account of the atom. How do

you know that the electrons in it neither lose nor gain a millionth part of a second in millions of years? Who timed them? The evidence available to me suggests that they are very frequently bumped out of their courses in the vast majority of atoms. Still less do I "agree that the odds are billions to one against the intricate co-ordination and co-operation of chemical compounds which is the necessary prerequisite of life on this planet." Nor do I believe that "spontaneous generation is *de fide* for the atheist." Some atheists have suggested that life is constantly being brought to the earth by spores driven by light pressure, and has had no beginning or end, to take one of the alternatives. However, I see nothing improbable in spontaneous generation. It was generally believed in until the eighteenth century by theists and atheists alike. Pasteur and others showed that the alleged generation of organisms large enough to be seen with a microscope did not occur when proper precautions were taken. But it would be very surprising if such relatively large organisms did start from scratch, so to say. If there is spontaneous generation it is almost certainly of much simpler living things, such as filter-passing viruses.

You are curiously wrong about chromosomes. The simplest cells have not got any; and their division very often goes wrong, which is why some plants produce so much bad pollen. Their allocation is not carried through "with unerring accuracy and discrimination." The science of genetics is largely based on the fact that mistakes occur so often that we can find out which genes are carried by a given chromosome. In *Drosophila melanogaster* the process goes wrong in about 2 per cent of the gametes. Like other vital processes, the allocation of chromosomes is just accurate enough to avoid serious damage to many organisms, and no more. This is what one would expect on Darwinian principles. Actually such processes occasionally work so badly as to cause a certain trouble even to Darwinists. Some flies produce a number of larvae from one egg. They can only form germ cells if they get a share of what is called the germ-cell determiner, and the distribution is so chancy that about 10 per cent of them don't get it, and cannot reproduce. It will be interesting to see whether this process is improved

in the next few thousand years, as it should be if Darwin was right.

Probably chemists have not yet produced a living cell in the laboratory. They have produced cell-like structures showing some of the phenomena of life, such as orderly pattern, growth, and division. But these structures, if they are alive at all (which is perhaps a matter of definition), certainly cannot carry on life indefinitely, any more than the sexless flies which I mentioned above. However, chemists are gradually reproducing the phenomena regarded as characteristic of life. It was said that only vital force could make organic compounds. In 1828 Wöhler made the first in the laboratory, and now hundreds of thousands have been made. Pasteur said fermentation was impossible without life. Buchner disproved him. We can already make many parts of the living cell, though not the majority. When chemists have either found some which present insuperable difficulties in manufacture, or have made them all but been unable to put them together as a going concern, it will be time to twit them with their lack of success. Meanwhile biochemistry goes on steadily in spite of your assertion of its failures. There is reason to think that a representative cell contains over ten thousand, but less than a million, distinct chemical substances. When there are ten thousand biochemists in the world it will be time to ask them to make a cell.

You accuse Darwin of evading an issue with which he was not concerned. He wrote on the origin of species, not the origin of life. I quite agree with you that "the survival of the fittest" does not offer an explanation of the origin of life. Nor does it purport to. It does, however, explain what you call "the upward trend" of evolution, i.e. the tendency of certain groups to become more complex. You say that a bacterium is just as fit to survive as a baby. Of course. But if there are bacteria there is an opening for something which eats them, e.g. a water-flea. And given the water-flea there is an opening for a fish which eats it. Now, if the fish is to survive, it cannot live like the water-flea, by soaking oxygen through its skin. It must have gills to serve this purpose. So the larger organisms can only survive if

they become more complicated. This is one of the reasons, in my opinion, why babies are more complicated than bacteria.

I have no particular faith in spontaneous generation. It may or may not have happened. If it happened it ought to be possible to repeat the process in the laboratory when we know more biochemistry. One reason for regarding it as probable is that there are a number of things which appear to bridge the gap between the living and non-living. Thus d'Hérelle thinks the bacteriophage is alive, and Bordet that it is not. It has some, but not all, of the properties common to most living organisms. The maxim *omne vivum e vivo* is a sound working hypothesis, as is "like begets like." But given the existence of these dubious forms, I do not regard it as necessarily universally valid any more than "like begets like." I have discussed the question at some length in *The Origin of Life*, reprinted in my book *The Inequality of Man.*

I think I may leave your jokes about the origin of sex to fall by their own weight. If you want an intelligent discussion of it, I recommend the last chapter of Darlington's *Recent Advances in Cytology*. But it is rather stiff reading, I fear. You ask me for a Darwinian interpretation of the origin of sex. Why not read Darwin, who devoted much of a rather long book to facts showing that plants were the better for crossing with other plants? Some of the reasons for this have since been discovered (see East and Jones's *Inbreeding and Outbreeding*). If, then, as the result of a mutation, unicellular organisms developed a tendency to periodic stickiness which enabled two of them to fuse, and exchange parts of their nuclei, we should have the beginnings of sexual reproduction. I anticipate your shattering reply that the process of exchange would have to be orderly by noting that in ciliate protozoa conjugation is fairly frequently followed by the death of one ex-conjugant as the result of the disorderly character of the exchange.

You next give us a sample of Macfie's inability to imagine facts which actually occurred, owing to his addiction to metaphors. "We can hardly imagine a shelled egg gradually giving up its shell," he says. Eggs do not give up their shells, but hens do sometimes give up secreting shells for

their eggs. The change from egg-laying to vivipary is a fairly simple affair in some salamanders. Here if the female finds water she lays her eggs in it. If she does not lay them some develop inside her, the embryos taking in not only oxygen but nourishment through their gills. The mammalian placenta similarly seems to have evolved from the allantois, the embryonic breathing organ of reptiles. The process took place in a number of steps, and some of the more primitive mammals have stopped half-way in the evolutionary process.

I do, however, agree with Macfie that most mutations are (metaphorically) mutilations. This seems to show that the process of mutation is not a designed process. Nevertheless, some mutations are advantageous in special circumstances.

I happen also to agree with Darwin's view about the eye. " How a nerve comes to be sensitive to light hardly concerns us more than how life originated," you quote. The whole central nervous system of primitive vertebrates such as the lamprey is sensitive to light. Most parts are protected from it. The unprotected parts in the head and tail respond to light. Now a mutation may make any tissue light sensitive, as the human skin becomes sensitive in haematoporphyria or xeroderma. The above property of the central nervous system probably arose in this way, and happened to have a positive survival value. As Darwin built his theory on the observed fact of variation, he was not concerned with the origin of particular variations.

You quote an unnamed Savilian professor of astronomy on the eye. This argument is dealt with by Fisher on pp. 38–41 of *The Genetical Theory of Natural Selection.* Fisher claims to prove mathematically that for a sufficiently small alteration the chance of improving an organ such as the eye is exactly one half, and not a minute fraction. Unfortunately, Fisher's argument is mathematical, and people who dislike accurate thinking will naturally accept the astronomer's "then I say" rather than attempt to find flaws, if such exist, in Fisher's mathematics. Like many mathematical results, they are rather paradoxical. Common sense tells us that if the earth attracts the moon with a force

increasing as their distance diminishes, the moon should fall down. It took the genius of Newton to prove that it would not.

To sum up, if I held your views on biology I should probably be compelled to believe in a creator or creators. But as, in my opinion, organisms are far from perfectly designed, and in fact have in general no more perfection than is needed to enable them to propagate their kind in face of competition, I find this hypothesis unnecessary. For you life is a series of miracles, for me a series of makeshifts.

But let us suppose for a moment that my reason forced me to abandon Darwinism for the theory of design by an intelligent being. What would follow? I find the lion furnished with strong muscles, claws, and teeth to attack the antelope, and the antelope with legs and horns to escape or ward off the lion. The two cancel out. Halve the speed of each, and their relative position would be the same. I find bacteria well equipped for invading man, and man protected from bacteria by a series of immune bodies, phagocytes, and so on.

Now, if I am observing a war I do not suppose that the same person planned the trenches and barbed-wire of one side, and the artillery with which the opposing side are trying to destroy them. The bacteria certainly did not think out toxins, or man antitoxins. If they were thought out at all, the obvious theory is that they were thought out by different gods. The leprosy god gave the lepra bacillus its coat of wax. The man god made the human skin, when intact, impermeable to leprosy, and perhaps made the chaulmoogra tree as a remedy. The lion god and the antelope god each armed his protegés, and so on.

The alternative to this extreme polytheism is something much less attractive. A single being may have designed all these things for his amusement. Like a Roman emperor at a gladiatorial combat, he or it may have armed man against leprosy and leprosy against man. It may please him to see the lion tear up a living oryx, or, alternatively, go off to die of sepsis with an oryx's broken horn in his belly. If these things do not please him, why did he make them so?

If this theory is correct the universe is something far more horrible than the most dismal of atheists ever imagined. "As flies to wanton boys are we to the gods. They kill us for their sport."

I reject this view firstly because I see no adequate evidence of intelligent design, secondly because in my experience great intelligence is not correlated with a delight in the suffering of others. Hence as a highly intelligent creator would probably not have created so much readily avoidable suffering, I deduce that the hypothesis of a highly intelligent creator is probably false. The same reasons lead me to reject the hypothesis of a highly intelligent organizer. Such a being would not have organized men and other living things for mutual destruction. But on the theory of natural selection this sort of organization was to be expected.

You give, as usual, an imposing list of quotations from Voltaire and theistic men of science. I note that Darwin is now called for the defence. Is it not a pity that you did your best to discredit him earlier? I don't propose to give you an even longer list of atheistic scientists, but to deal with certain of the points raised.

I am interested to learn that Paley's watch was stolen from Voltaire. Had I lived in the eighteenth century I should probably have been a deist, like Voltaire and Tom Paine. But since Voltaire's time the arguments for an intelligent creator have been extensively disproved, those based on the universe in general by Laplace in his *Mécanique Céleste*, those based on living creatures by Darwin in his *Origin of Species*. Voltaire got rid of enough relics of prescientific thought for one lifetime. In carrying on the good work I regard myself as his disciple. I am quite sure that I take all sorts of things for true which further scientific work will prove to be false. If in future anyone regards himself or herself as my disciple they will be very poor disciples if they stop where I stopped.

About half of your quotations merely protest against the view that the universe is the product of "blind chance," whatever that may be, and mechanism. With this protest I am in complete agreement. As my father put it, "The emergence of life out of a Newtonian world would be a

quite unintelligible miracle." But it is you, if anyone—certainly not I—who postulate such a miracle. As it seems to me, if life is to be explained, a piece of matter which is alive, say a tubercle bacillus, must have properties beyond those at present known to physicists and chemists, or alternatively be guided by an immaterial intelligence. You will retort that I am giving the whole case away and appealing to faith by postulating such unknown properties of matter. The answer is simple. If physicists and chemists knew all the properties of matter there would be no point in carrying out further research in those sciences. If, on the other hand, physics and chemistry had done nothing in the past to explain the phenomena of life it would be foolish to expect such explanations of them in the future. But they have done a great deal.

You seem to think that the alternative to theism is mechanism. I cannot see why. There are very many intermediate possibilities. Because I do not support absolute monarchy it does not follow that I am an anarchist. Because I do not regard a cabbage as a bit of machinery like a clock it does not follow that it is controlled either by a soul of its own or by a series of interventions of omnipotence.

The cabbage is alive, but not, I think, sentient or intelligent, though perhaps its individual cells may have some slight degree of sentience. If unorganized matter showed no characteristics like those of living organisms this would suggest a radical gap in the universe. But the work of the last ten years strongly suggests that atoms have some of the properties generally attributed to living things, though not beyond the range of mathematical analysis. You seem to admit the existence of nothing between the crudest mechanism and self-conscious intelligence. I think that life is in between. I also think that there are various other kinds of aggregate. For example, I think that "England" means something more than a geographical area or a mere aggregate of forty million human beings. (This may of course be a patriotic delusion.) But I certainly do not think, with Mussolini, that England is a being with a consciousness of its own.

Of the various assertions of theism I will only consider

my father's. He ascribes the name "God" to an eternal mind, which, however, in his opinion, did not create the world and does not intervene in it by individual acts of will, that is to say, miracles. Now I think that there are good, though not completely cogent, arguments for the existence of such a mind. But I disagree with my father on the question of terminology. Such a being is not what you mean by the word "God," nor what the vast majority of religious people have meant by that word. And I think that to call it by that name merely brings confusion into the arguments in which it is used. Certainly such a being is not a first efficient cause.

Lest you should think that this attitude is a peculiarity of my own, adopted for the purpose of this argument, let me quote Shelley, who was expelled from Oxford for writing "The Necessity of Atheism." In his seventh note to "Queen Mab," on the phrase "There is no God," he wrote: "The negation must be understood solely to affect a creative Deity. The hypothesis of a pervading Spirit coeternal with the universe remains shaken." I do not propose to discuss the pros and cons of this latter hypothesis, simply because if it is true, Christianity, at least as you understand that word, is false. And I think that this falsity may be proved by arguments which do not depend on the truth or falsity of the "coeternal spirit" hypothesis, which is one alternative to it, but not the only one.

In my letter examining St. Thomas's arguments I expressly stated that I did not mean by the word "God" a world soul, or an absolute, but a creator. I had assumed that you accepted this exclusion.

The fact is that if by "God" you mean, as I am sure you do, a creator intervening in the world by miracles, then my father is an atheist, and a much more dogmatic one than I. I think it unfortunate that he should use the word "God" for the being in which he believes, if only because the quotation of single sentences from his work is likely to mislead the unwary.

Your arguments from nature to its alleged designer lead very conveniently to my thesis that theism, in the sense of belief in an almighty and otherwise perfect creator, is an

immoral doctrine. If we arrive at the idea of God by the contemplation of nature we must judge of his nature by his actions, as we do of the human watchmaker. Now some of his creations are admirable. I think of flowers, waterfalls, and good men. Almost if not quite all show great ingenuity.

But there is another group, smaller perhaps, but large enough, which I have spent much of my life in an attempt to destroy. At the present moment I am particularly interested in retinoblastoma. This tumour grows in the eyes of children, generally starting before the age of one year. It later becomes exceedingly painful, and inevitably causes death before the age of six, unless the eye is removed at a very early stage. In many families it is strongly inherited. Theologians have hesitated between the theories that such diseases are a punishment for human sin, ancestral for choice, or that they are a test of fortitude, resignation, or some other virtue.

You will remember that last year it was revealed that the dictator of Mundo had seized on some of the infant children of the revolutionary leader Adamoff and tortured them in an atrocious manner for a number of years. The shock to world opinion was not lessened by the apologies of his press bureau. Some said that these children were being justly punished for their father's crime. Others gave out that this torture would make them into good citizens. If the analogy of the watchmaker is fair, so is the above paragraph.

Just as the creator turns out on some occasions to behave as well as the best of men, on others he behaves worse than the worst. Again a self-contradiction, or, as you put it in your correspondence with Joad, a mystery. It is an interesting fact that in most theological arguments the word "self-contradiction" can be substituted for "mystery" without substantially altering the meaning. It is also noteworthy that the God of Christianity is far more mysterious and self-contradictory than those of other religions. His goodness as shown in the incarnation exactly neutralizes his wickedness in demanding such an atoning sacrifice. In Christianity the self-contradictions inherent in theism are

brought to a head. For this reason it is a most satisfactory poetical symbol for the unsolved enigmas, moral and intellectual, of the universe.

But as a standard of morality it is fatal. The good man cannot reach the level of virtue embodied in the traditional figure of Christ. But the bad man cannot reach the abysses of cruelty and malevolence which we must attribute to the creator of the more painful diseases. Every Christian tyrant can console himself with the thought that God inflicts worse evils than he upon the innocent. The atheist tyrant has no such refuge from the promptings of common humanity, even if he has no such exalted ideals as are found in Christianity at its best.

The belief that the creator is good is immoral for two reasons. In the first place it justifies human cruelty, particularly as exercised by the State. And secondly it discourages any active steps against natural evils. "I betake me for refuge to the Lord of the daybreak against the evils of His creation," said Muhammad (for please do not think that I am attacking Christianity only). In 1832 the British nation attempted to combat an epidemic of cholera by prayer and fasting, because they thought it was God's will. We are less religious now. In such cases we boil our drinking water. But it is natural that people who regard cholera as one of God's works are less likely than atheists to look for means of prevention. On account of the more self-contradictory character of their religion Christians are more likely to do so than Muslims. (By the way, if you want to demolish me with the name of Pasteur I have an answer ready.)

I think that this moral argument against theism has made far more atheists than the rebuttals of the creation hypothesis. As soon as man's technical progress enables him to combat successfully such alleged divine creations as cholera he is inevitably led to atheism. The decay of religion, like its spread, depends largely on emotional causes. If cholera is a punishment for our sins, men can still respect its creator. If it is a punishment for not knowing when to boil one's drink, such an attitude becomes very much more difficult.

To sum up, if you want me, or our readers, to believe in a good God, do not argue back to his existence from his alleged works.

Perhaps, in parenthesis, you may permit me to explain my position with regard to morality. Some standards or other are needed, though you may call your ideal sportsmanship, honour, good taste, public spirit, common decency, or even decline to name it. I agree with you that conduct motivated by no other fear than that of escaping punishment does not deserve to be called moral.

Now, your moral code may either stand up by itself or be propped up. By a propped-up moral code I mean one which purports to be based on something other than pure morality, such as religion or patriotism. One may do good actions for love of one's country, or of God. But in the long run the props are secondary. You reverence God because you think He is good. If you did not think so I hope that you would have the courage not to reverence Him.

Now props of some kind are necessary, at least for most people. Our morality needs a bit of artificial stiffening. But it is very important to choose the right props. I submit that the creator may serve as an adequate prop in an age where wholly uncritical views of nature are universally held (read some mediaeval bestiaries and lapidaries if you think this unfair to their writers and readers). But as soon as one begins to study nature as it is it becomes impossible to regard its creator as wholly admirable.

Christianity tries to escape this consequence by concentrating on Christ rather than nature as revealing the character of God. By doing so it falls into a self-contradiction which already renders it incredible to many people, and which, I think, will ultimately help to bring about its downfall.

I am surprised that you claim not to have attacked scientific method. It rather reminds me of Professor J. S. Huxley's claim (doubtless sincere, as in your own case) to be a supporter of religion. In his case you would, I think, say (and I should agree with you) that he was actually attacking most, though not all, of the things characteristic of religion. Similarly you attack most, but not all, of the characteristically scientific methods of thinking.

Let me illustrate this from your last letter. "The finite mind is reduced to impotence when confronted with the problems of the infinite." I deny this *in toto*. Ever since Newton wrote *Analysis per aequationes numero terminorum infinitas* in 1669 the finite minds of mathematicians have been dealing successfully with these problems, though the modern theory of the infinite dates from the nineteenth century. If you think that such problems are mathematical toys divorced from reality, read the *Bell System Technical Journal*, and you will realize that modern telephone practice, to take a simple example, depends on these ideas. Rather than see these ideas applied in cosmology, you take refuge in "reverence before the incomprehensible." This has always been the attitude of enemies of science. It has infected scientific men too. Johannes Müller declared the problem of the speed of nervous impulses to be insoluble in 1844. Helmholz measured it in 1850. And so on.

In your discussion of intolerance you say that Catholics think that only trained and experienced investigators should undertake psychical research, and tell me that I have experimented upon myself with poisonous gases. Actually I have not tried breathing anything particularly dangerous since the war, but I have swallowed various chemicals up to what I think was over half the lethal dose. You suppose that I would not have allowed my less-experienced pupils to do the same. When I began this work I had no experience whatever of taking these substances. Nor had anyone with whom I was in contact. I had nothing to guide me but a knowledge of chemistry and a materialistic (but not mechanistic) theory of how I worked. Nor had my pupils. And we could not have had any experience. Experience of taking ammonium chloride is no more guide to taking urea than experience of high diving is a guide to mountaineering.

You think that Holy Church knows the main facts about spirits, and can decide who is competent to investigate them. You may conceivably be right. But you are certainly wrong if you think that anyone knows what is going to happen in an experiment until they try it, if it is really a new one. Your attitude would effectively prevent any real progress in those branches of science which involve possible danger. The

Wright Brothers were not experienced aviators when they started flying! By the way, I think you exaggerate the dangers of possession. I knew an ex-medium who was sometimes possessed, or purported to be possessed, by an evil spirit. It was asked where it came from, but did not answer, "Why this is hell, nor am I out of it," or words to that effect, as had been hoped. The medium's hand wrote "From Aleister Crowley's. This is our evening out." (In case Mr. Crowley should take offence, I hasten to add that I do not believe the truth of this assertion. In my experience such "spirits" are incorrigible liars.)

Of course some spiritualists have gone mad, just as some biochemists have been poisoned; but if there is any truth in spiritualism that is a small price to pay for it. My friend retained his sanity.

But your anti-scientific attitude can most readily be seen in your constant appeals to authority. You are always quoting eminent scientists, or so you tell me, for quite often I have never heard of them. And you really seem to regard such appeals as a substitute for reason. You ask for the name of a first-class mathematician converted to Darwinism by reading my papers. Now, there are, on my estimate, about a dozen first-class mathematicians in this country, and I do not suppose that any of them has read my work which does not embody any great advances in mathematics. (My only contribution to pure mathematics was published separately.) But this is not the point. One third-rate mathematician who finds a hole in my reasoning could decide the question. The mathematics involved in the relevant part of my work could be grasped by anyone who had done Math. Mods. at Oxford, or Part I at Cambridge, let alone a final examination. If you think I am wrong, why not get a person of this kind to examine it? Your attitude reminds me of that of Mr. Belloc, who, in a recent number of *Discovery*, demolished Darwinism in one sentence by pointing out that it rested on a mathematical fallacy. In the next number I begged him to expand his disproof of this damnable heresy, so that I, for one, could follow it. He was, however, I suppose, too busy to do so.

Your passion for authority leads you to quote rather

unfortunately for yourself. Professor MacBride concludes from the few (perhaps fifty thousand or so!) cases in which mutations have been experimentally produced by X-rays, heat, etc., that they are due to some damage to the developmental machinery of the nucleus in the germ cell. Now some of them may be, but others are not, for a very simple reason. By X-raying a fly with normal bristles you get a mutation which produces twisted bristles. These are inherited by the progeny of the mutant. On further X-raying these flies Patterson got a mutation back to normal. Now one of these may be "damage," but the contention that both are so can only be paralleled in a nursery rhyme:

> There was a man of Thessaly, and he was wondrous wise;
> He jumped into a bramble bush, and scratched out both his eyes;
> And when he saw his eyes were out, with all his might and main,
> He jumped into another bush, and scratched them in again.

Similar results were obtained by Timoféeff-Ressowsky in recent numbers of the *Zeitschrift für induktive Abstammungs- und Vererbungslehre* (golly, what a paper!) as regards a whole number of characters. The disappearance of mutant forms in nature, when it occurs, is presumably due to natural or sexual selection. But those which one of my pupils has recently let out in Devonshire seem in no great hurry to disappear, though I expect they will.

While we are on mutants, may I answer two of your questions. I think many cases of mutation are perfectly explicable. On the other hand, I make no claim to explain the origin of life, among other reasons because I do not know if it originated. However, the recent progress of physics seems to me to make such an explanation vastly easier than appeared likely twenty years ago.

You repeat some statements with which I cannot concur. You say that there is no evidence for "major evolution," a term which you leave so vague that I am unable to pin you down. I confess that I should like to show you a series of fossil skeletons of mammal-like reptiles and reptile-like mammals, and to ask you where you drew the line between the two classes. Would you draw it at the appearance of

mammalian teeth, at the doubling of the occipital condyle (skull-neck hinge), the transformation of the quadrate bone into an auditory ossicle, the disappearance of the coracoid bone, the change in the position of the ankle-joint, or where? According to which criterion you used you would make your division at a different point. But I do not doubt that wherever you made it you would triumphantly convince yourself of the "complete failure" of palaeontologists to find intermediates between reptiles and mammals.

Your case against "major evolution" is largely based on the assertion, unsupported by any evidence, that "species evolve within the framework of very definite limitations." I have spent a good deal of the last twenty-three years looking for these limitations, without much success. The limitations certainly do not include mutual fertility, as was once thought. As for size, look at a St. Bernard dog and a Pekinese. As for form, they do not include such fundamental characters as the number of legs and wings in an insect. Unless you can point to something more definite I cannot argue further with you on this topic.

You ask me if I have read Vialleton on the limbs and pelvic girdles of vertebrates. I have not, as his book was written since I studied comparative anatomy. You also ask for a series of sketches of intermediates between a land animal and a whale. I am not a good sketcher, but some would be very like caricatures of seals and dugongs, which would illustrate the gradual transformation of legs into tail. The walrus can still walk on his hind legs. In the British seals they are permanently stuck out behind. In the dugong the hind limb-bones have disappeared, though there is a good deal more pelvis left than in the whales. I wonder, by the way, why the eocene Zeuglodon is not regarded as an intermediate between whales and land mammals. It had limb-bones, which modern whales lack.

I still cannot find the passage in which you say I "poured scorn" on the theory of polyphyletic evolution. I said that I thought it was getting less and less probable. I did not even express complete disbelief in it. The reason why no intermediates have been found between some of the great phyla (e.g. arthropods and chordates) is fairly obvious.

The most primitive members of these phyla are generally small animals with no skeletons or very tenuous ones. So were the hypothetical intermediates. Hence they left no fossils.

About mathematics I fear I have not made myself clear. A mathematical theorem is something very abstract. Take the theorem about the squares on the sides of right-angled triangles. This is true if you choose the right set of axioms from which to deduce it, i.e. if the axioms are true. You suggest that I want to examine every right-angled triangle in the universe. Now neither of us has ever seen (or felt) a right-angled triangle. We have merely seen objects approximating to one. For scientific purposes we want to be sure that this theorem is approximately true for these approximations to right-angled triangles. This depends on how we measure them. Euclid's measurements depend on drawing circles. If we cannot draw a sufficiently accurate circle, e.g. because our compass is affected by temperature or relativistic shrinking, then the proposition becomes as inapplicable to real objects as a proposition in four dimensional geometry. Hence it seems to me fully justifiable to test how far some of the approximate triangles in the real world conform to this theorem. I think sufficiently large ones would not, unless one adopted a very queer system of measurement.

Similarly with the multiplication table the question arises whether there may be a class of beings to which our ordinary methods of counting do not apply. If so, the rules of arithmetic are not universally valid. My calculations apply to things like rabbits and dandelions, which can be counted. But I "take the pose seriously" that one ought to test one's assumptions. Your statement of the Athanasian creed amounts to this, that if you count the members of the Trinity as persons there are three, if you count them as gods, only one. (How all this can be reconciled with St. Thomas's belief that God is not in any genus, and that we have only negative information about Him, I leave to theologians.) It seems to me that if you hold to the multiplication table in this case you deny the validity of the process of counting, and conversely. I don't much mind

which you deny. The opposition to common sense is sufficiently startling in either case.

You have not made the case for Dewar much better by pointing out that some of his fossil genera, whose number is so strikingly large, are based on evidence which you think inadequate. You also say that he "claims that if we were to split each of his periods into a hundred thousand sub-periods, we should still find at least forty-five genera in each period represented in fossil form." Either this means that he claims that many fossil genera have been found at a hundred thousand different levels, which I am sure he does not, or he is appealing to the evidence of hitherto undiscovered fossils, a practice which I gather does not meet with your approval.

But let me try to justify its legitimate use. If the geological record were complete we should have to postulate fantastic jumps which could hardly be explained without postulating miracles. It is therefore important to point out that the record is incomplete. On the other hand, the complete absence below the Permian of fossils which could possibly be regarded as mammalian (to take a single example) is an impressive fact, not of course conclusive, but one of a vast number which are explained by the theory of evolution.

You must remember that science, like common sense, always goes beyond the facts at its immediate disposal. I do a simple analysis and say that a given crystal is nickel sulphate. This is a prophecy, on the basis of a few observed properties, that it will have the other properties of that substance. Such prophecies sometimes break down, but not often enough to discredit them.

You point out that I can produce no single scientific fact telling against the possibility that God might create two closely allied types. Of course I can't. If God is almighty He can create what He pleases. If you find a dog in the street and take it home, it is quite possible that God created it as a reward for your faith. But that belief would be a poor defence to a charge of stealing by finding. It is to my mind far more likely that a good creator made the fossils as a joke, than that he made the tubercle bacillus as a means

of killing children painfully. The argument against special creation is just that it is out of harmony with our experience and that the origin of species can be explained otherwise. Evolution is no more proved than planetary gravitation. If you prefer to believe that God moves the planets round in paths very close to those predicted by Newton's laws I cannot disprove your theory. On the contrary, you can argue that the slight unexplained anomalies of the moon's motion are definite evidence for your view, being miracles in the sense of unexplained and (at present) unpredictable phenomena. No scientific theory whatever is immune to this sort of criticism. But science carries on in spite of it, because in spite of its numerous lacunae and occasional mistakes it is a remarkably good guide to practice.

As to Lourdes, I cannot agree that Dr. Lainey was a competent ophthalmologist. On looking at the woman's eyes he said that she must be blind. In fact, women whose retinae have the appearance described by him can sometimes see, although no miracle is claimed. This fact makes me dubious both about the miracle and about the diagnoses made at Lourdes.

I asked you for a miracle there performed which "violated the laws which apply to all physiological phenomena investigated in the laboratory, such as the conservation of energy." I fear you misunderstood me. You give Carrel's opinion that "in the course of a miraculous cure, the rate of tissue construction greatly exceeds that which has ever been observed in a wound healing under optimum conditions." It is equally true that in rats injected with growth hormone the rate of tissue construction greatly exceeds that which has previously been observed in a rat of the same size. But I see no evidence that either event is a violation of the laws applying to all physiological phenomena, as for example the transformation of water into wine at Cana, if it happened, was a violation of the fundamental laws of chemistry which (apart from miracles) hold within the body as outside it. I certainly do not see why this rapid healing in a very few people is any more remarkable than the suppression of blistering and pain from burns under deep hypnosis, which one can produce in many, perhaps a

majority, of subjects. We have no idea what are the limits of such phenomena, whether, for example one person in ten thousand would not respond to hypnosis as dramatically as the miraculously cured people at Lourdes. Unfortunately, psychological research is very badly endowed, so we shall probably have to wait till the fourth Russian five-year plan to get our answer to such questions. And perhaps even then this problem will not be included in the research programme!

We must now return to the rather dreary topic of intolerance. If you think that a good case cannot be made out for persecuting witches, read Pope Innocent VIII's Bull *Summis desiderantes*. If you still think there is no case, are you not endangering your soul by doubting the justice of this august pronouncement? I know that there are two schools of opinion as to when a Pope is infallible, but, even so, is it not temerarious to disagree with the Vicar of Christ?

I am surprised that you think that a biologist who did not believe in evolution would have any difficulty in being elected to the Royal Society, if he were good enough. I agree with you that it would handicap him for a chair at certain universities. But so would a Cockney accent or extreme political views of any kind. Professorships are not given for scientific achievement alone. The Royal Society tries, at least, to keep up to this ideal, except for the fellowships given to princes of the blood royal, and to politicians and other useful people under Rule 12. Being a human institution it does not succeed completely, but I think heretical views on evolution might be rather a recommendation to a society whose motto is *Nullius in verba*, and which has a rule "never to give their opinion, as a Body, upon any subject, either of Nature or Art, which comes before them."

I still maintain that, from your description of Dewar's paper, it was a paper of the kind published in *Biological Reviews* and not in the *Proceedings of the Zoological Society*. Did he try to get it published in *Biological Reviews*, the *Quarterly Review of Biology*, or *Science Progress*? In his place I should have tried those journals in that order, and then *Biologia Generalis*. If all these turned it down it might be time to talk of intolerance.

Finally we come to the question of *Nature*. You say that I have pointed out that psychical research was noted by *Nature* for the first time in 1924. This is untrue. Taking down volumes before that date at random I find one reference in Vol. 106 and two in Vol. 107. I particularly recommend a review on June 8th 1911 of a book by Canon McClure attacking spiritualism, in which the reviewer defends mediums against the charge of being hysterical. You may, if you like, say that *Nature* does not give enough attention to the supernatural. But your statement that it refused, for sixty-nine years, to consider it, seems to show that you will believe any accusation against scientific men without troubling to look up the evidence, and makes me very sceptical of your other stories of scientific intolerance.

I will at once withdraw my suggested reason for the inadequacy of St. Thomas's arguments if you can prove that atheists in the thirteenth century had a chance of discussing the existence of God with Dominicans, without risking their lives. What actually happened in some discussions at that time is well illustrated by an anecdote in de Joinville's *Life of King Louis IX*. A discussion between clergy and Jews had been arranged at the abbey of Cluny. A knight asked the leader of the Jews if he believed that Mary was a virgin and the mother of God. The Jew said he did not. The knight hit him on the head, which terminated the discussion. The abbot remonstrated, but when the matter was referred to the king he approved of the knight's action and added, "Aussi vous di je, que nulz, se il n'est tres bon clerc, ne doit disputer a eulz, méz l'omme lay, quant il ot mesdire la loy crestienne, ne doit pas deffendre la loy crestienne ne mais de l'epée, de quoi il doit donner parmi le ventre dedans, tant comme elle y peut entrer" ("I also tell you that no one, unless he is a very good clerk, should argue with them, but the layman, when he hears the Christian law attacked, ought not to defend it save with his sword, which he should plunge into the [miscreant's] belly, as far as it will go").

There was at least one atheist in France at that time, namely, Geoffrey of Lusignan, who went into battle with the war-cry "Non est deus." We do not know by what

arguments Geoffrey would have sustained this thesis, for he copied the methods recommended by King Louis, and on one occasion burned an abbey containing a hundred monks. He may have suspected the monks, with some justice, of intending to burn him. But these two episodes will perhaps make it clear why an argument between a Dominican and an atheist was likely to be unhealthy for one or other participant. It only remains to add that the Church canonized King Louis, while Geoffrey is not held up as a model by atheists. Indeed, I only discovered his motto in an obscure German pamphlet on French mediaeval verse which I was reading for another purpose.

I hope that I have answered all your questions. Will you try to explain two things? First, why an infinite regress in movers, causes, or dependence of other kinds, is impossible? Secondly, why it is legitimate to argue back to the character of the Creator from design for good, but illegitimate to do so from design for evil?

Yours sincerely,
J. B. S. Haldane.

XXVIII.

THE CONFLICT BETWEEN SCIENCE AND ATHEISM

September 27, 1934.

My dear Haldane,

You are a bit of a puzzle, you know. You have read Catholic works the titles of which are unknown to the average secularist, and yet you trot out with tremendous gusto the sort of remarks which one associates with the most uneducated of atheists. It is, for instance, odd that a man with your philosophical training should imply that there is an antithesis between praying to God in times of plague and boiling our drinking water. By parity of reasoning we could show that there are only two reasonable ways of climbing the Matterhorn, either to climb without guides or to employ a guide to drag one's inert form bodily to the summit. One need not necessarily cease to help oneself because one asks God (or a guide) to reinforce one's efforts.

You began this correspondence convinced that Catholics regard science with hostility. The only evidence you have produced to justify this odd view is the fact that the Church forbids unqualified people to pursue one, and only one, form of research.

Here are a few names of eminent Catholic scientists which have passed into common speech, Copernicus, Pope Gregory, Galvani, Ampère, Volta, Coulomb, Mendel, Pasteur, Röntgen and Marconi. Modern astronomy is Copernican; our calendar is Gregorian; iron is galvanized; electricity is measured by amps, volts and coulombs; cattle-breeding is conducted on Mendelian principles; milk is pasteurized; you make use of Röntgen rays for your experiments; and Marconi has enabled people of your way of thinking to inform the wireless public that the Church to which Marconi belongs is the enemy of science.

"As soon as man's technical progress," you write, "enables him to combat successfully such alleged divine creations as cholera he is inevitably led to atheism," which is why

Pasteur died an atheist. "As soon as one begins to study nature," you write, "it becomes impossible to regard its author as wholly admirable." And now we know why Abbé Mendel called his classic work "The Shady Side of God."

You are entitled to say that *your* study of nature leads *you* to an atheistic conclusion. But it is absurd to imply that this is a general experience, for the majority of scientists have been and still are theists. You must try to be less subjective.

Your attempt to prove that I am unscientific is rather pathetic, for there is nothing unscientific in my tempered agnosticism about the powers of the human mind to solve *all* problems of the infinite, nor is it unscientific, as you suggest, to reinforce one's arguments by citing authorities in one's support. It is only courteous to mention a writer whose argument one has borrowed, and nobody but a fool would assume that the only arguments worth mentioning are those which he has himself discovered. Again, it is as legitimate for me to quote scientists against you as it is legitimate for you to quote papal bulls against me, more legitimate indeed, since, whereas we *both* believe in science, you don't believe in the Pope. And on the question of Thomistic philosophy, on which my opinion is scarcely more valuable than yours, it is legitimate to quote the views of experts, Catholic and non-Catholic, to prove you wrong.

My object is to convert atheists to theism, and as our contemporaries are more impressed by the bad reasons advanced for theism by eminent scientists than by the good reasons advanced by eminent theologians, I shall be more effective if I quote scientists than if I quote theologians. But remember, however, that the grocer does not necessarily eat the margarine which he sells.

I hasten to add that I am well aware of the fact that some modern scientists have made a valuable contribution to religious philosophy.

In point of fact it is you people who appeal to authority. One can hardly open a modern book on evolution without coming across some sentence which attempts to browbeat the reader into accepting evolution as a proven fact by an

appeal to authority. "All educated people accept evolution" is the kind of phrase which turns up again and again in evolutionary literature, a phrase which is a falsehood. It is clear that if I blindly trusted in authority I should not be criticizing evolution at this moment, for the great majority of Catholic scientists and the overwhelming majority of non-Catholic scientists are convinced evolutionists.

And now for St. Thomas. I tried to suggest, as gently as I could, that you don't possess the necessary knowledge to criticize St. Thomas with effect. But why all this heat? I have devoted much more time to Darwinism than you have to scholastic philosophy, and yet I accept your corrections on scientific points with unruffled good-humour. Why this tremendous hullabaloo when I point out that you have travestied St. Thomas? This statement is not, as you seem to think, a reflection on your "intellectual honesty." It is a reflection on your intellectual acumen, or, if you like, on your rashness in attacking St. Thomas without taking the necessary trouble to discover what he really meant.

By all means print the five proofs in an appendix, if only as an awful warning against superficial criticism. The *Summa* is full of traps for people who never dig below the surface. St. Thomas was a theologian, not a prophet. He was writing for contemporaries, not for twentieth-century readers, who had no knowledge of the great controversies of his day. Even if you could show that the first argument is tolerant of your interpretation, and I concede that you are not the first person to be misled by it, you would only impress people who knew nothing of St. Thomas's background. For whatever else St. Thomas meant there is one thing he could not have meant. He could not have meant, as you suggest, that an infinite regress is impossible, since he shocked his contemporaries by proving that the orthodox arguments purporting to prove the impossibility of an infinite regress were invalid. And whatever else St. Thomas meant by "lead to the best possible result," he could not have meant that we are living in a perfect world, since he devotes much attention to the problem of imperfection.

You completely missed the point about my rejoinder on the subject of *Bilharzia*. I was trying to convince you that

it was absurd to suggest that the discovery of parasites has *added* anything to the problem of evil as it existed in St. Thomas's day. *Magis et minus non mutant speciem.*

It is essential to your case to show that St. Thomas, and I, regard organisms as "perfectly designed," and you pay no attention to my disclaimers, preferring to credit me with the views which you find easiest to demolish. St. Thomas says of the eye "*Oculus dicitur malus, in quantum caret acumine visus*" ("The eye is called bad in so far as it lacks acuteness of vision"). My point is not that the eye is perfect but that its relative efficiency is inexplicable without invoking the hypothesis of a directing intelligence outside of nature.

I have no space to take up in detail various other points that you raise, such as the false analogy between dividing a line into points and a series of movements in a crowd. And I should be interested to know why you suppose that Catholics believe that universals such as "twice two equals four" are "causes of events in time."

Whenever I come across the trite phrase "humble searchers after truth," I suspect that it is intended to introduce a statement which is certainly not humble and probably not true.

Only a fool would suppose that he had complete knowledge about any event in this world. Professor Taylor, an eminent mediaevalist, is not a fool. No further comment is needed on your sentence, "Some humble searchers after truth will consider that Professor Taylor's argument is sufficiently refuted by the claim that it leads to complete knowledge about any event." If you were as humble as all that, you might begin to suspect that you had misunderstood an argument which leads you, but not Professor Taylor, to so grotesque a conclusion. Professor Taylor's point is surely this, that we can only know that a thing is not an illusion if we can find its *raison d'être*, that the world would consequently be unintelligible if there were no God, but that the world is intelligible because God is not only the explanation of everything in the world, but also His own explanation.

Even stranger are your comments on Professor Patterson's

statement that God is self-explanatory, or rather not on Professor Patterson's statement, for he is merely interpreting St. Thomas Aquinas. You have no right to accuse him of speaking of "a self-explanatory source of motion," merely because he has taken the trouble to find out what St. Thomas Aquinas really meant. Incidentally, it is strange that you should use the Thomist theory that our knowledge of God is of an indirect and negative character as an argument against the Thomist truism that God is his own self-explanation. To believe that God is His own explanation is not the same thing as to believe that God explains Himself completely to man. God may be completely intelligible to God without being completely intelligible to Haldane.

An even funnier example of this subjectivism is your lovely remark, "The main argument against the hypothesis of a creator is that we have no analogy in our experience of creating something out of nothing." In other words, because we can't make something out of nothing, God can't. The "main argument" against the existence of God is the fact that God cannot possibly be cleverer than Haldane. Once again it is your subjectivism which misleads you. All of which helps me to understand that odd remark in your book, *The Inequality of Man* (p. 213): "If I thought that the aims of science and art were merely material, I should belong to some church." The failure of science to satisfy your ideals would be no argument for the objective truth of religion. If you sought admission to the Catholic Church, and gave as your reason the fact that you had come to the conclusion that the aims of science were material, you would be politely informed that dissatisfaction with science was no reason for becoming a Catholic. There is only one adequate reason for that step, the conviction that Catholicism is true.

The distinction between the fifth argument and Paley's argument from design in nature depends on the distinction between what Thomists describe as extrinsic and intrinsic design. My object is to prove that God exists, and not to expound St. Thomas. I will therefore not digress into the technicalities of Thomistic philosophy.

It is, of course, easier to psychoanalyse me than to meet my arguments, but even if you could prove that it was a

longing for intellectual rest which had made me a Christian, you would not have refuted Christianity. It is perhaps fortunate that I have no longing for intellectual rest, since I see no prospect of attaining it on this side of the grave.

Nor do I feel any need, as you suggest, to solve the contradictions of the world by the hypothesis of a self-contradictory God, but then I do not agree with you that the world "is full of contradictions." I see no contradiction in the fact that "things are at once large and small," or, as I should prefer to put it, that "large" and "small" are relative terms, for my knowledge of St. Thomas may well be small compared with Father D'Arcy's and yet large compared with yours.

And, if we are thinking of the same passage in the *Phaedo*, I think that Plato would have agreed with me. The word he uses is "opposition," not the same thing as "contradiction."

My position is that the finite mind is competent to deal with some aspects of the infinite, such as the infinitesimal calculus, or the proof that an infinite God exists, but is not necessarily competent to resolve all the apparent contradictions which seem inevitable in every discussion of ultimate problems, whether in theology or in science. By omitting the important word, "ultimate," you make me say something silly. I do not suggest that we should "take refuge in reverence before the incomprehensible," though I am prepared to kneel before the *ultimate* incomprehensible, that is to say, before God.

And I dissent strongly from your complaisant contrast between your intellectual curiosity and my resigned ignorance. Lethargy before the incomprehensible is a charge, as I have shown, which may fairly be brought against the type of scientist who is deterred by snobbish timidity from investigating the sort of phenomena regarded as ridiculous by the mental fashion of the moment—ectoplasm, ghosts, Lourdes miracles, or, shall we say, the Loch Ness monster? It is no credit to the British Association that it was left to private enterprise to finance the investigation of this particular problem. The attitude of most scientists to these unusual phenomena reminds me of the story of the simple

countryman who was taken to the Zoo and shown a giraffe. "I don't believe there's such an animal" was his comment.

You do less than justice to your father's religion if you equate his God with "an eternal mind which, however, in his opinion did not create the world, and does not intervene in it by individual acts of will."

"The conception of God," he writes, "to which the analogies of our experience has led is not that of a perfect being existing apart from the ignorance, sin and suffering of our own world, but present within and around us, sharing in our struggle." A God who does not intervene in the world by individual acts of will is very different from the God who "shares in our struggles."

I should be interested to learn what are the "cogent arguments" which you have discovered for the non-intervening type of deity. I suspect that there is little more than Fif to support your belief in an eternal mind which did not create the world and which does not intervene in it. There is abundant evidence, philosophic and scientific, for the Christian God, and this hypothesis provides a convincing explanation of the origin of the world. Your "eternal mind" solves no problems and creates new difficulties.

I am interested that you should profess yourself, in some sense, a disciple of Plato, for it was Plato who foisted on us this conception of an eternal mind too dignified to have any truck with vulgar matter.

Plato lived in a society which idealized sexual perversion, and which attributed to its deities the grossest of carnal acts. The Platonic contrast between the purity of the mind and the grossness of the body was the result of a violent reaction against excessive carnality. It was left to Christianity to insist that there is nothing necessarily evil about the body, and nothing gross about the physical functions of sex.

The Incarnation was a splendid protest against the denigrement of the body. *Deus qui humanae substantiae dignitatem mirabiliter condidisti et mirabilius reformasti . . . humanitatis nostrae fieri dignatus est particeps.* The God whom we worship is not an eternal mind unsullied by contact with matter, but the God who marvellously dignified

the human nature which he created, and became a partaker of our humanity.

The Platonic infection against which Christianity has always had to fight has taken many forms, Gnosticism, Manicheism, Puritanism and neo-Platonism.

I note with pleasure that you agree with me in disliking the expression "expanding space," and with interest that you defend mathematical conceptions which you describe as "often incomprehensible and self-contradictory," on the ground that these often "lead to perfectly definite consequences which can be verified or shown to be false." I do not see how a consequence can be "shown to be false," but perhaps you meant "conclusion." You then attack the hypothesis of God on the ground that it cannot be used "as a source of new predictions capable of verification *or otherwise*."

The italics are mine, and my first point is to claim that hypotheses can be divided into useful and useless in accordance as to whether they lead to conclusions which can be verified or shown to be false. You seem to regard a hypothesis as valuable provided only it leads to predictions, irrespective of whether those predictions are capable of verification.

My second point is that the hypothesis of God is the source of predictions which can be verified. The Victorian Bishops, for instance, deduced from the hypothesis of God the conclusion that the moral code based on theism would decline as theism declined. The Victorian agnostics were outraged at the suggestion that they were attacking the traditional sex morality in which they whole-heartedly believed. The Victorian agnostics were, for the most part, deeply hurt by this charge. They loudly protested their loyalty to the Christian code and their unshaken confidence that this code would survive in a world which abandoned the Christian creed. I am not, at the moment, defending the Christian code, nor implying that a hypothesis is necessarily true because predictions based on it are fulfilled. I content myself with stating that the Victorian Bishops were more accurate in their predictions than the Victorian agnostics; in other words, that the hypothesis of God led to

conclusions which have been proved true, notably in Russia, and that the hypothesis of no-God has led to conclusions which have been proved false.

We are discussing the truth of theism rather than the consequences of that belief, but I cannot pass without comment your astounding statement that "as a standard of morality it [theism] is fatal," or your implication that atheists are more compassionate than Christians. I do not want to drag in contemporary politics, so I will not ask you to prove this thesis from the one great country which has officially adopted atheism as the State philosophy. I will content myself with one quotation which seems to me to sum up the pitiless character of humanitarianism when divorced from religion. "The world and its future," writes Mr. H. G. Wells, "is not for feeble folk any more than it is for selfish folk. It is not for the multitude but for the best. The best of to-day will be the commonplace of to-morrow. If I am something of a social leveller, it is not because I want to give silly people a good time, but because I want to make opportunity universal and not miss out one single being who is worth while."

The further that men move from the Christian doctrine of the infinite value of every human soul, the more rapidly will they approach the Utopia of the humanitarian where beings who are not "worth while" will be painlessly extinguished.

It will always be easy to find people to distribute other people's money, and to work out five-year plans for the regimentation of their neighbours. It will always be easy to find generals for the humanitarian army, but I fancy that there will be some difficulty in a non-Christian world in discovering people to undertake those "fatigues" which carry no reward either in prestige or in power or in money. Mr. Wells does not wish to give "silly people" a good time, but Christ did not die for clever people alone. The saints who model their lives on Christ have been the first to lavish love and affection on the dreary, on the unattractive, and, in brief, on the silly people for whom Mr. Wells has no manner of use.

But to return to your suggestion that the hypothesis of

God is of no scientific value. A hypothesis may be of scientific value if it leads to predictions which can be verified or if it explains phenomena otherwise unintelligible. The hypothesis that God exists fulfils both these tests. We can make predictions which we can verify as to the type of character produced respectively by the belief and disbelief in God, and we can show that this hypothesis alone provides a reasonable explanation of the origin and development of life.

It will, I think, simplify the remainder of our discussion if you will allow me to ask you certain questions which I shall number to facilitate and (I hope) to ensure replies:

1. Is there any philosophic or scientific reason to suppose that the "eternal mind" in which you are inclined to believe is impotent to create or to influence the world?

2. Why are you so prejudiced against the possibility of miracles, which you define as the intervention by God in this world by individual acts of will? If Haldane can intervene in this world by individual acts of will, why should not God?

3. Do you agree that the question as to whether God exists and the question whether God intervenes by individual acts of will should be decided by the evidence and by the evidence alone?

4. If your answer to the last question is in the affirmative, do you agree that it is a gross *petitio principii* to demand for such individual acts of will on the part of God a higher standard of evidence than you demand for such events as the alleged evolution of a reptile into a bird?

5. Is there anything unscientific or inconsistent in the view that the human mind though powerful enough to prove that God exists is not necessarily competent to understand all aspects of an infinite God? Is it really so strange that there should be these residual difficulties in theology as in science? I have already quoted Lord Rayleigh's remark in his presidential address to the British Association: "The scientific worker knows in his heart that underneath the theories he constructs there lie contradictions which he cannot reconcile."

And, as you know, these discrepancies are not confined

to theology. Sir William Bragg, in his Robert Boyle lecture, for instance, called attention to the discrepancy between the theory of the explosive action of electrons and the "firmly established" wave theory. "We are obliged," he said, "to use each theory as occasion demands and wait for further knowledge as to how it may be possible that both should be true at the same time. Toleration of opinion is a recognized virtue. The curiosity of the present situation is that opposite opinions have to be held or used by the same individual in the faith that some day the combined truth may be made plain."

The case for God is reinforced not only by the improbability of the only alternative, mindless evolution, but also by the character of the arguments which you are reduced to employing. For instance, in your last letter you again confuse succession with descent, in spite of my clear warning in a previous letter. For I am not trying to prove that fishes and mammals were created simultaneously. I am amused that you should solemnly trot out the absence of mammal fossils below the Permian as an argument for evolution by descent. It is, of course, only an argument for succession, but as the successive appearance on the planet of different types is common ground to both of us, the sooner we get back to the questions on which we disagree the better. And the point at issue is whether this succession can or can not be explained by the purely natural process of evolution by descent.

Now will you kindly answer a question which I have asked more than once without obtaining a reply:

6. Why do you assume that the geological record is complete enough to justify your confidence that no inconvenient fossils will be found in the missing volumes of Nature's book (i.e. mammals below the Permian or birds below the Triassic), and yet not complete enough to justify the deductions which the anti-evolutionist draws from the absence of fossils linking the great phyla? In other words, the evolutionist is, and the anti-evolutionist is not, permitted to draw definite conclusions from the absence of certain fossils.

Here is another example of the sort of reasoning which arouses my deep distrust. You confuse two entirely different

things, a lineage *series* of intermediate types, between, say, reptiles and mammals, and the existence of certain stray specimens which possess both reptilian and mammalian characteristics. Cannot you see that there is a world of difference between a definite lineage series of evolving types connecting reptiles and mammals, and a few isolated specimens which you find some difficulty in classifying; or do you seriously propose to reinforce the argument from the imperfection of the geological record with a new argument based on the imperfection of scientific knowledge? Finally you fall back on the favourite refuge of evolutionists in distress, flat-earthism. "Oh, of course," says the evolutionist, "it is always possible to criticize any scientific theory. A case can be made out against planetary gravitation or the roundness of the earth." A flagrant *petitio principii* which assumes as proved the very question which is in dispute, the question as to whether the evidence for evolution is as strong as the evidence for planetary gravitation or for the roundness of the earth.

If the evidence for evolution was as strong as the evidence for planetary gravitation, and if the difficulties of accepting evolution were as small as the difficulties of accepting the roundness of the earth, then clearly we should all be evolutionists. Your variation of the "flat earth" argument is to keep on trotting out the analogy about the angels moving round the planets. I have asked in vain (Question 7) the name of any mediaeval university in which this particular astronomical theory was ever officially taught.

My answer to all this sort of thing is simple. I have already quoted the confession of a noted evolutionist, Delage, to the effect that if we take our stand "on the exclusive ground of fact, it must be acknowledged that the formation of one species from another has never been demonstrated at all." No eminent scientist has suggested in modern times that "the exclusive ground of fact" provides no foundation for the theory of planetary gravitation. The Royal Society includes at least one admitted anti-evolutionist. It does not include a flat-earther or disbelievers in planetary gravitation.

If you could produce, which you can't, any lineage series

to link any of the great phyla, I should be converted to evolution, but it is disingenuous to sweep aside in this airy fashion the fundamental difficulty of your case. Indeed, the familiar phrase "missing link" is misleading, for it suggests that only one link is absent. It would be far more correct to speak of "missing chains," for there is no lineage series leading up to shells and feathers, both of which make their first appearance not in an experimental but in the final stage, and there is no lineage series of intermediate types linking any of the great orders, such as fishes and amphibians, amphibians and reptiles, reptiles and mammals, the alleged bestial ancestors of man, and man himself.

It is for you to explain why the geological record should be comparatively rich in examples of minor evolution, and completely barren of records of major evolution.

And this is the place for a mild grouse. Your pose of affecting not to understand simple words like "chance," or expressions which I have been careful to define, such as "major evolution," would be irritating even if I had not taken the trouble to define exactly what I meant by these words and phrases. My definition of "chance" as "the product of physico-chemical forces undirected by intelligence" is very similar to yours, "physical processes undirected by mind." I prefer yours because it is simpler, but the slight difference between these definitions does not justify your superior attitude. If you wish me to illustrate what I mean by major and minor evolution I will repeat what I have already said. The change from one kind of horse into another kind of horse (*Eohippus* into *Equus*) is what I call minor evolution. The change of one type of animal into an entirely different type of animal—a lizard into a bird, say—is what I should describe as major evolution; and by evolution within definite limitations I do not mean what you apparently think I mean. I mean the evolution of a horse within the definite limitations of horsiness. I leave you to translate these nice, homely illustrations into appropriate scientific jargonese.

My own practice is to use the single word "chance" in preference to a long phrase, provided I have defined the word in question; but then I am not a scientist.

Here is a sentence from Huxley: "The aetiology of crayfishes resolves itself into a gradual evolution in the course of the mesozoic and subsequent epochs of the world's history of these animals from a primitive astacomorphous form." In other words, Huxley believed that the crayfish has evolved from something simpler. But if he had said so, somebody like you might have asked him what he meant.

Now we come to the dog. "If you find a dog in a street," you write, "it is quite possible that God created it as a reward for your faith. But that would be a poor defence to a charge of dog-stealing." Of course it would. But the bearing of all this on our argument is difficult to detect.

I am flattered that you should so obviously prefer to attack beliefs which I do not hold than to meet the beliefs which I do. I do not regard life as a series of miracles, though I believe that it is just as possible for God, as for Haldane, to intervene in the affairs of this planet by individual acts of will. I do not invoke a miraculous explanation unless (*a*) no satisfactory natural explanation has been advanced, and unless (*b*) there is strong evidence for the supernatural alternative.

If I stole your dog I should not expect Catholics to believe that the dog had been miraculously created by God as the reward of my faith, because there would be (*a*) evidence for dog-stealing, and because there would *not* be (*b*) evidence for dog-creating. I have said all this sort of thing several times in the course of this correspondence, but I am a patient sort of chap, so I'm not complaining.

It is, indeed, you, not I, who "play the dog" to escape the difficulties of your position. (You remember the bridge problem. Z drops the ace of trumps and Z's dog eats it. Can Z play the dog?).

For instance, you "play the dog" to explain the origin of life on this planet, but I am, however, relieved to note that you don't commit yourself irrevocably to the theory that life was borne here on spores driven by light pressure, an explanation which, as Mr. Chesterton somewhere says, is much as if we explained the appearance of a ghost in our parish by suggesting that the ghost came from another parish.

The logic of atheism inevitably drives the atheist to deny that life ever had a beginning. The atheist, indeed, must "play the dog" by suggesting, as Haeckel did, that even the atom has a kind of life, and that there is life even in the sun. Just as you could not refute me if I chose to assert that a dog which I was charged with stealing had been miraculously created as the reward of my faith, so I cannot refute you when you assert that all existent forms of life were once latent in a fiery cloud, a theory which Tyndall, no friend of theism, declared to be obvious nonsense.

Atheism, indeed, forces a man to choose between this absurdity and the fantasy of spontaneous generation. Either life exists in the flaming sun, or it must have made its appearance at some point in time on a cooling planet, either on this planet or on another planet, and you do not solve the problem of spontaneous generation by explaining that this took place on another planet.

I accept your correction of a statement for which the Wells-Huxley book *The Science of Life* is my authority: "Each kind of living thing has its characteristic chromosome outfit. . . . The gametes, then, have exactly half as many chromosomes as the cells of the zygote" (p. 284). But I don't think this correction helps your case. For even if there be simpler cells capable of passing on life to descendants without the chromosome outfit, it is impossible to believe that this elaborate method of reproduction developed by pure chance out of the primeval rocks.

You have not answered the point about the upward trend of evolution. The case stands thus. If survival was what nature aimed at, nature would never have produced anything more short-lived than a rock. The survival of the fittest, the alleged clue to evolution, does not explain the arrival of creatures no more fit than their simpler ancestors to survive. A bacterium is as fit to survive as a baby. To this you reply that the water-flea appeared because bacteria were already in existence to provide water-fleas with nourishment. You are confusing two entirely different propositions. You do not prove that A will necessarily be followed by B because you have shown that B cannot exist without A. You do not explain why water-fleas should

have appeared by showing that bacteria are a necessary condition for the existence of water-fleas. Similarly, you do not explain the *arrival* of the larger organisms by pointing out that the larger organisms could not exist unless they became more complicated.

Even if chemists had produced a living cell, which they have not, they would not have provided an adequate explanation for the origin of life on this planet, unless they could produce not only a living cell, but a parent cell capable of handing on life to its descendants.

I am not in the least inclined to "twit chemists with their lack of success." It is you, not I, who show surprise at the suggestion that chemists are not quite so clever as God. I thank you for your statement that "a representative cell contains over ten thousand distinct chemical substances." All of which, on your hypothesis, came together by pure chance.

Again, Darwinism makes no real attempt to explain the origin of sex, for if "the survival of the fittest" was all that nature aimed at, it is impossible to discover why the old-fashioned and successful method of reproduction should ever have given place to the sexual method. Incidentally, I was asking you to explain not so much the physical evolution of sex as the psychical. The origin of sexual passion is an even greater difficulty than the origin of sex.

Darwin, you reply in effect, was as little concerned to explain the origin of life as the origin of light. I agree. His book, in spite of its pretentious title, makes no attempt to explain origins, and yet this is the book which, according to you, would have converted Voltaire from theism to atheism had he lived. I wonder. This was not Darwin's view. The last sentence of *The Origin of Species* remained unchanged through the various editions, and may therefore be taken to express his considered opinion on theism. By the way, there is no reason why I should not quote Darwin where he talks sense because he often talks nonsense. You might as well forbid me to quote the concluding sentence of his famous book because the sentence in question is woolly, badly expressed and characteristically ungrammatical. Here it is:

"There is grandeur in this view of life, with its several powers, having been originally breathed by the creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved."

Your belief that Darwin, who remained a convinced theist, would have converted Voltaire to atheism is as disarming as your conviction that the eminent scientists whom I have quoted against you would have been converted to your views had they lived long enough to read your books. Voltaire dismisses atheism with contempt, but Voltaire had not read Darwin or the mathematical equations with which you vindicate Darwin. Delage says that we have no real facts to justify our belief in evolution, but Delage, poor chap, died before you created a new species and saw that it was good. Professor Bateson, that eminent anti-Darwinian, died before the new revelation had flooded the world with light.

All this sort of thing would be so much more impressive if you could produce some living anti-Darwinian who had been converted by your mathematics, such as Professor MacBride. And this should be easy if, as you say, an Honour Mods' standard qualifies a critic to understand your equations. There must be many anti-Darwinians whose mathematics are up to the standard of Honour Mods. If none of them has been converted it is a reasonable assumption that the deceased anti-Darwinians would have persisted in their errors even had they survived to read your book.

The fact is that the arguments which appealed to Voltaire have been greatly strengthened by the progress of science since Voltaire's day. By the way, you point out quite correctly that most Christians accepted spontaneous generation until comparatively recently. In a sense they did, but St. Thomas Aquinas, who neither affirmed nor denied the possibility of spontaneous generation, insisted that if life was produced from inanimate matter, it must be because God has endowed matter with special powers for this purpose. This is a very different thing from believing that mud and sea could spawn cells capable of evolving by their

own unaided efforts into all existent forms of life. St. Thomas Aquinas knew that only a supernatural act of creation can produce plus out of minus. He knew that there can be nothing in the effect which was not present in the cause, a truism which you apparently deny. But if you do not deny this truism, it is for you to prove that the steaming seas and cooling rocks of the primitive planet contained an adequate cause for the effects which followed —life, intelligence and consciousness. You cannot have it both ways. You cannot deny by implication this patent truism, and then affect to be amused when I state this truism. Of course intelligent achievement is the sign-mark of intelligent design, but this is not quite the same thing as asserting that "if intelligence is there, it is there." My point is that creation is an intelligent achievement, and cannot be explained excepting by the hypothesis of an intelligent creator. I am glad that you are beginning to realize that the intelligence which is patent in the method of reproduction adopted even by simple cells is the sign-mark of an intelligent designer.

I do not, however, agree that there is a complete analogy between the co-ordinated movements of wave patterns and the complex co-operation of the wheels of a watch, or of the different parts of a body.

It is strange that Darwin, who was intelligent enough to realize that God was essential to start the evolutionary progress, refused to see that God was even more indispensable as an explanation for beauty. "When the materialist," writes J. B. Mosley, "has exhausted himself in efforts to explain utility in nature, it would appear to be the peculiar office of beauty to rise up as confounding and baffling *extra*."

Consider, for instance, the glorious symmetry of the colour patterns on the reverse side of the wings of the common blue butterfly, and the upper side of the wings of the peacock butterfly or the silver fritillary. The complexity, perfect balance, and symmetry of these designs is as remarkable as the perfection of their colour harmonies.

All of which Darwin accounted for by the odd theory that beauty has its survival value and that the females of

the species selected (hence the name "sexual selection") the showier and more attractive males for their partners.

Of course nobody denies that a bright flash of crude colour may have some kind of sexual appeal, but this is a very different thing from explaining these intricate patterns by sexual selection. The argument is admirably summarized by Mr. Noyes in his book *The Unknown God*, and I hasten to add that I am quoting the argument in his words not because I am "appealing to authority" but because the argument itself appeals to me, and I know that I cannot improve on his effective presentment of the case:

"It was unreasonable to suppose that, in choosing their mates upon the wing (as butterflies always do) and a wildly fluttering wing at that, the butterfly wooers would be seriously influenced by exquisitely delicate approximations to a single, exact, formal, artistic design among the innumerable possible arrangements of thousands of minute flecks of colour. The colours were by no means all 'gorgeous,' as Darwin suggests. Many of them are of the most ethereal and subdued tones, and the patterns have the formal perfection of an intellectual scheme. They have no loose ends; they are worked out to the last minute detail in the artistic correspondence of a point here to a point there, and the curve in a line here to a curve in a line there, while every detail fits perfectly into the scheme as a whole; for each design has a real unity. . . .

"We can hardly suppose that Jane, the Painted Lady, preferred the fluttering Robert to the fluttering William because Robert had a minute moon with a slightly more delicately shaded halo on one wing, and this arrangement corresponded more precisely to a similar moon and its halo on the opposite wing. If we can accept this, we can hardly suppose that generation after generation of butterflies would adopt exactly the same criterion until those minute moons were at last perfectly placed in the exact positions aesthetically required by an elaborate pattern, every other minute detail of which had to be worked out in the same way with a unanimous critical fervour, until the long and intricate picture was finished in that perfect unity whose relationship no insect is likely to perceive at all."

Darwin's theory was crudely anthropomorphic, and in effect assumed that insects possessed much the same aesthetic criterions as men, which is absurd.

Incidentally the ape, which Darwin believed to be our closest relation, seems to possess a far less developed aesthetic sense than the butterfly, which is all wrong if evolution is a progress from the simple to the complex. For the blue patch on his behind, which the ape proudly displays when he wishes to make a favourable impression upon the female heart, is an extremely crude colour scheme compared to the glorious patterns of the butterfly.

Darwin believed that Darwinism stood or fell with his theory of sexual selection. He declared that if it could be proved that these beautiful patterns had been created to delight man or the creator, this conclusion would be absolutely fatal to his theory.

I agree. The complete breakdown of all materialistic attempts to explain beauty is one of the chief arguments against not only atheism but also Darwinism.

You will reply that Darwin should not be criticized for refusing to answer questions with which he was not concerned. The man who professed to explain the origin of species must not be pressed to explain the origin of life, the origin of passion, the origin of sight or the origin of a sense of beauty. It would apparently be caddish to hiss just because this benevolent old conjurer "plays the dog" whenever he is at a loss for an explanation. I suppose this is what Huxley meant when he talked about Darwin's "marvellous dumb sagacity." Certainly the attempts of evolutionists to explain the problems which Darwin ignored increase our respect for Darwin. His dumbness was certainly more sagacious than their speech. Consider, for instance, the attempts that have been made to explain the origin of our appreciation of music. I remember reading somewhere that music is pleasurable because it is associated with happy memories of the noises our ancestors made at the sight of food.

I think it was Herbert Spencer who assured us that strong emotions are associated with muscular exertion. The muscles of the abdomen contract and expand under emotional

stress, and the noises which result revive by association the pleasurable emotion which engendered them. To this primordial coincidence we owe first of all cadenced speech, and then music.

Which explanation is the greater tax on our credulity? Is it easier to believe that music delights us because it causes emotions associated with some primeval howl at the sight of food, or that music opens a window into a world of eternal values?

Here, at least, we may be in agreement. "I believe," you write, "that the scientist is trying to express absolute truth and the artist absolute beauty." If you believe, as this confession suggests, that the ephemeral beauty of this world is a reflection of eternal and transcendent beauty, I do not see how you can stop short of a belief in God. "I have not very much use," you write, "for people who are not in touch with the invisible world." When I challenged you to explain this statement, you replied, in effect, that you are referring to a world of universals. And is it really sensible to divide people into your soul-mates who realize that twice two is universally and eternally four, and your spiritual inferiors who can only think of twice two in terms of pigs, pounds or potatoes? And what precisely do you mean by "absolute beauty"? I think I know. You mean very much what St. Thomas meant when he declared that "the beauty of creatures is nothing less than the likeness of the beauty of God," and your phrase "absolute beauty" is as near as the fashion of your school will allow you to approach to the more scientific phrase, "the beauty of God."

When the dawn moves across the face of quiet waters or the sun reddens the evening snows we seem to sense absolute beauty. Why should this be so? Can we explain in purely physical terms the reaction between the lump of matter called the Wetterhorn and the lump of matter called Arnold Lunn? I think not, for I believe that the response of the soul to visible beauty is the response of spirit to spirit. *Cor ad cor loquitur.*

"Science," you tell me, "always goes beyond the facts at its immediate disposal." You must forgive me if I follow the example of science and confess that, to me at least,

beauty in its noblest manifestations always seems to be in some sense an incarnation. The eternal substance which was revealed beneath the accidents of flesh and blood in far-off Palestine, and which is revealed beneath the accidents of bread and wine on the altar, does not disdain the tabernacle of matter.

I wonder what is your explanation of the impression produced by mountain beauty. This is no mere rhetorical question, for I feel that you are really in a position to help me, since you claim to know "from personal experience what it feels like to consist of an abnormally large or small amount of calcium carbonate, of which the limestone mountain is built." From which it would seem to follow that cross-examining you is the next best thing to interviewing the Wetterhorn.

You have completely missed Dewar's point about the fossils. All he claims is that if we can show that a particular specimen was in existence at two different dates we are entitled to assume that this particular species existed at every period between those dates.

If, for instance, we were to divide up the period of time during which a particular species of horse roamed the surface of the earth into ten sub-periods, and if we found a fossil of this species in the first and in the fifth and in the tenth sub-period, we should not assume that this species of horse was miraculously blotted out at the end of the first period, miraculously created again at the beginning of the fifth, miraculously blotted out at the end of the fifth, and miraculously created again at the beginning of the tenth. We can't "play the dog."

The only other alternative would be to believe that this species of horse became extinct at the end of the first sub-period, and that a piece of protoplasm began to evolve rapidly at the beginning of the second period and reached the horse stage again at the beginning of the fifth sub-period.

To cite a concrete rather than a hypothetical case. The common mole belongs to the genus *Talpa*. A fossil of this genus has been unearthed, so I believe, from an Oligocene deposit. The common mole exists to-day. With incredible

rashness Dewar and I therefore assume that the common mole has been in existence in every one of the divisions of time, however minute, from the Oligocene up to the present day.

I thought it best to refer your comments on Professor MacBride's remarks to Professor MacBride. He has replied at great length, and I will summarize the more important points in his deeply interesting letter.

His first point is that the leading systematists who have given their lives to classifying species, disagree with you. This, by the way, would seem to be a legitimate appeal to authority. The question as to what is and what is not a species is a matter of opinion. The reader has to decide between your opinion and the opinions of leading systematists such as the director and the three head keepers of our National Museum, the leading systematists of the Berlin Musuem, and the great American systematist Sumner, all of whom agree that *mutations have had no share in the formation of species.*

You are mistaken in supposing that Professor MacBride's conclusions are based only on cases in which mutations are alleged to have been produced by X-rays, heat, etc. His conclusions are the result of twenty years' study of mutations as a member of the Council of the John Innes Research Institute at Wimbledon, the headquarters of genetical research in this country.

Professor MacBride cites the views of Mohr, who was described by the late Dr. Bateson as "the leading Drosophilist in Europe," and who has shown that the "damage" which characterizes mutations is damage to vigour rather than to outward visible structure.

As regards the alleged results of your experiments, Professor MacBride does not for one moment impugn your good faith, but long experience has taught him to receive with the utmost scepticism the results of experiments of "Drosophilists" in America. A mutation is a cramping or distorting of the powers of growth of the germ affected by it; but underneath this malign influence the ancestral constitution of the germ continues unchanged. A mutation, as the late Dr. Johannsen expressed it, is "a superficial disturbance of the

chromosomes." So long as the conditions which produced the mutation continue, it will be faithfully reproduced in each succeeding generation, in a word, "truly inherited." But if the conditions are changed and approximate more to the natural environment, the mutation will gradually pass off and the ancestral form will be restored.

Thus domestic pigs introduced into New Zealand by Captain Cook in 1790 ran wild and by 1840 had become genuine wild boar. It frequently happens that when a mutation is bred under healthy conditions for some generations specimens turn up more like the normal type than the mutation. Even in the tubes in which Drosophila is bred this occasionally occurs. This has been described by Professor Julian Huxley as "mutation backwards," and of course if this change be claimed as a mutation such mutations are certainly not due to fresh damage. In reality they are not mutations at all but reversions.

In the case you quote you have assumed what it is your business to prove. All you have shown is that the descendant of a mutilated fly has reverted to the ancestral type. If, as Professor MacBride believes, mutations tend to disappear, it may be that the twisted bristle mutation disappeared independently, and that the reversion to type was not caused directly or indirectly by the second dose of X-rays. *Post hoc* is not the same thing as *propter hoc*.

Professor MacBride concludes his letter with a sentence the full significance of which will not, I hope, escape our readers:

"Professor Woltereck, who is the greatest authority on the inhabitants of fresh-water lakes, especially the minute crustacea, has shown that so far from a new species being formed by a single jump, its development is a very slow and gradual affair. He shows that to find the beginning of a new race, we must go back to the end of the ice age at least 10,000 years ago, and that for the origin of a genuine new species we must go back beyond the glacial age altogether, a matter of 3–400,000 years."

Your case for evolution rests very largely on your conviction that you have produced a genuine new species.

Delage, you tell us, would have recanted his view that there was no real evidence for the transmutation of species had he known of your experiments. It is rather a pity, isn't it, that those best qualified to judge what is and what is not a new species have yet to be converted?

Let us see where we stand. Darwin believed that the main agent in the evolutionary process was the natural selection of favourable variations. This view is completely discredited to-day. The neo-Darwinians believe that the main agent of the evolutionary process is the natural selection of favourable mutations. For this view there is no evidence that would be accepted by those who are best qualified to decide the classification of species.

Neo-Lamarckians believe that the main agents of evolution are the efforts of the individual to adjust itself to its environment. Lamarckianism stands or falls on the inheritance of acquired characteristics for which there is virtually no evidence.

In other words, every explanation which has been put forward to explain evolution is riddled with hopeless difficulties, and yet we are assured that nobody but a fool could deny that evolution had taken place.

If the evidence for evolution was overwhelming, we might wait patiently for an adequate explanation, but if the evolutionary process is as slow as Professor Woltereck assures us, if it takes half a million years to form a new species, billions of years are probably necessary to form a new genus or a new order or a new family. Where then are the billions of intermediate types that the evolutionary theory demands?

I am not, as you suggest, concerned to prove either that the only rational alternative to theism is mechanism, or that nothing can exist "between the crudest mechanism and self-conscious intelligence." My thesis is that you have signally failed to explain either the origin of life or the evolutionary process by pure chance, that is, "by physical processes undirected by mind."

I am an evolutionist in so far as I believe that minor evolution can be explained by purely natural causes. I am a "creationist" in so far as I believe, with Darwin, that the

evolutionary process must have been started by a supernatural act of creation. I am also a "creationist" because the geological record tells against major evolution, and because it is therefore reasonable to suppose that the purely natural process of evolution must have been assisted at certain points by creational activities.

You seem to admit no alternative between purely natural evolution and the crudest kind of fundamentalism, in which you differ from Wallace, who shares with Darwin the credit (or discredit) of propounding the theory of natural selection. He was inclined to believe that there were "three stages in the development of the organic world when some new cause or power must necessarily have come into action," the first when the first living cell was created, the second when the animal kingdom separated from the vegetable kingdom, and the third at the creation of Man.

We both hoped, when we began this book, to discuss many things which will have to be omitted, the evidence for the Resurrection, for instance, and our respective remedies for the parlous condition of the world in which we live. The book is already much longer than we intended, and it is time to bring it to an end. I shall therefore raise no new points in any further letter which I may write, and shall content myself with reinforcing my arguments against your criticisms.

We began this correspondence by debating whether the Christian approach to truth was more scientific or, as you think, less scientific than your own approach, and we then proceeded to discuss whether the origin and development of life can best be explained by the hypothesis of a directing intelligence external to this planet or by physical processes undirected by mind. You introduced St. Thomas's metaphysical arguments, but apart from this digression I have made no attempt to develop the traditional arguments in defence of Christian theism, for I do not think we have yet reached that stage in the debate in which it is profitable to pass from a discussion of the existence to a discussion of the

nature of God. It is therefore both premature to introduce at this point the familiar moral argument against the belief that God is both omnipotent and perfect, and illogical to assume, as you apparently do assume, that the existence of evil invalidates the argument for the supernatural.

No intelligent discussion of theism is possible if, as is always the case in arguing with atheists, four separate issues are treated as one (1) Does God exist? (2) Is God one or many? (3) Is God omnipotent? (4) Is God good?

Bilharzia, for instance, who has to support (poor parasite!) your whole case, throws no light whatever on the first of these questions, since the existence of nasty parasites is quite consistent with the belief in a God who is benevolent but not omnipotent, or in a God who is omnipotent but malevolent. In other words, we must prove that the world owes its existence to an external intelligence before we proceed to discuss whether this intelligence is one, omnipotent and benevolent.

The title of this book is *Science and the Supernatural*, not *Science and Christianity*, and still less *Science and Catholicism*. My thesis is that Nature is not self-explanatory, and that the origin and development of life cannot be explained by purely natural causes. In other words, we require super-nature to explain nature. Now if the existence of evil does not invalidate the argument for the supernatural, your parasites, etc., have no relevance at least at this point in the argument.

I realize that in your letter on St. Thomas you do allude to various non-Christian conceptions of God, but by an ingenious sleight of hand you have conveyed the impression that your arguments are, in effect, an answer to my contention that nature is not self-explanatory.

If we had nothing to go on but design in nature, we might find some difficulty in refuting the theory that the world is a battle-ground between a God who is far from omnipotent and a devil who is far from powerless.

Manicheism, the belief that God and Satan are two equally powerful and co-eternal spirits for ever contending for mastery, is indeed the only plausible alternative to Christian theism.

Your letter ends as follows, "Will you try to explain two things. First, why an infinite regression in movers, causes or dependence of other kinds is impossible? Secondly, why it is legitimate to argue back to the character of the creator from design for good, but illegitimate to do so from design for evil?"

I have made it clear that neither St. Thomas nor I assert the impossibility of an infinite regression in movers. As to dependency, I have nothing to add to what has already been said in my previous letter.

To your second question I reply first that we argue from design to the existence rather than to the character of God, and secondly that I do not regard as "illegitimate" arguments based on design for evil, but I believe that such arguments can be met and refuted.

The evidence of Nature may not point irresistibly to a belief in a Deity who is both omnipotent and perfect, but the evidence does suggest that things have been, in the main, arranged to ensure the happiness of living creatures. "The popular idea," writes that eminent Darwinian, A. R. Wallace, "of the struggle for existence entailing misery and pain on the animal world is the very reverse of the truth. What it really brings about is the maximum of life and enjoyment of life with a minimum of suffering and pain. Given the necessity of death and reproduction—and without these there could have been no progressive development of the animal world—and it is difficult to imagine a system under which a greater balance of happiness could have been secured." And he adds elsewhere, "The probability is that there is as great a gap between man and the lower animals in sensitiveness to pain as there is in their intellectual and moral faculties."

May I then ask you two more questions?

(8) Do you agree that every effect requires an adequate cause? (9) Do you agree that intelligence in the effect implies intelligence in the cause?

Let me quote in conclusion a passage which I am sure you know from Kessler, the astronomer:

"Yesterday, when weary with writing, and my mind quite dusty with considering these atoms, I was called to supper,

and a salad I had asked for was set before me. 'It seems then,' said I aloud, 'that if pewter dishes, leaves of lettuce, grains of salt, drops of vinegar and oil, and slices of egg, had been floating about in the air from all eternity, it might at last happen by chance that there would come a salad.'

" 'Yes,' said my wife, 'but not so nice and well dressed as this of mine is.' "

Chance is a fantastic explanation of a salad, and a grotesquely fantastic explanation of the universe.

ARNOLD LUNN.

XXIX.

QUESTIONS ANSWERED

16 Park Village East.
Oct. 30, 1934.

Dear Lunn,

At the end of my last letter I asked you two questions, why an infinite regression in movers or causes is impossible? and why the argument from design for evil is invalid? You have answered neither, besides ignoring many less important questions. It may be, as you say, that my analogy with other infinite series is wrong, though you have not told me why. Even if my alleged disproof is ineffective that does not prove that St. Thomas was right. Again I examined St. Thomas's argument in the *Summa contra Gentiles* with some care, and claim to have rebutted it; yet you do not tell me where my rebuttal was incorrect, but merely that I ought to read more mediaeval philosophy.

You do not answer the second question because you do not think it "profitable to pass from a discussion of the existence to the discussion of the nature of God." But one cannot discuss the existence of a being whose nature is undefined. If you merely mean by "God" something of which we know very little which existed before any of the things that we can see at present, I am a convinced theist. The important question is whether this something is a being with the various perfections which you attribute to it and I do not.

Actually we should have had more time to discuss this fundamental problem had you not put off the discussion till it was too late. This enabled you to devote most of this book to such minor questions as evolution, attacking what you regard as my weak points instead of defending what I regard as yours. This is sound tactics, but possibly bad strategy, since it may suggest to some readers that your position in indefensible.

Though you have not answered my questions I will gladly answer yours.

(1) Yes, there is a philosophical reason to suppose that

an eternal mind, if it exists, can not or does not create or influence the world, in the sense of being an efficient cause of events in it. In the first place, the argument from analogy breaks down, because a finite mind cannot create a finite amount of matter. That is not the kind of thing which, in our experience, a mind does. Hence I do not see why one should suppose that an infinite mind can create an infinite (or perhaps only very large) amount of matter.

But the main argument is more serious. God is alleged to be a changeless being. Now, when I influence the world by an act of will, this constitutes a change in me as well as in the world. Hence the attribution of a series of acts of will (not to mention incarnation) to a changeless being seems to me impossible. Of course this is a very real difficulty to the hypothesis of an eternal mind or spirit, since all minds that we know do change. The main argument for the existence of such a mind is that I find it difficult to see how a system of universals can exist except in such a mind. However, it may be that such words as "mind" and "spirit" in this connexion are mere anthropomorphisms.

(2) I share what you call a prejudice against the intervention of God in the world by individual acts of will with St. Thomas, who wrote: "But in God there is only one being. Therefore in Him there is only one act of will."[1] Hence if there is an eternal and changeless mind I shall look for evidence of its existence in the unchanging features of the universe, i.e. in universals, and not in the changing features, such as miracles, if they occur. Of course if you can convince me that there are miracles which can only be ascribed to an eternal mind, I shall have to change my opinion of that mind.

(3) No. The questions of God's existence and intervention should not be decided by the evidence alone, but by arguments from it, just as in a court of law we hear not only witnesses, but the counsel and judge.

(4) I agree that it would be unfair to demand a higher standard of evidence for the acts alleged to be individual

[1] *Summa contra Gentiles*, Bk. I, Chap. 76

acts of divine will than for the alleged evolution of a reptile into a bird. But the question is whether these occurrences were or were not acts of God. Before we answer this question we must therefore decide first whether God exists, and secondly whether, if He exists, we can attribute a number of acts of will to Him. In answering the second question in the negative, I have at least the consolation that St. Thomas was of the same opinion.

(5) No. There is nothing wrong with the view that the human mind is incompetent to understand all aspects of an infinite God. But we can legitimately refuse to believe in a God with self-contradictory attributes. If Sir William Bragg were as dogmatic about the attributes of electrons as St. Thomas was about those of God, you would have a good case against him. The evidence for the existence of electrons is very strong. You can see the tracks they leave when going quickly through a gas. The electrons may be defined as the causes of such tracks. It is not, however, clear whether they are to be regarded as particles, systems of waves, or something else. I am willing to concede to you the existence of God, provided we leave it open whether the word defines a person, the principle of concretion (Whitehead), the goal of our striving (Alexander), or something at present undefined.

(6) I do not make the assumption about fossils which you attribute to me. I have little doubt that "inconvenient fossils" (i.e. fossils disproving some people's theories about the descent of some groups) will be found. One cannot draw definite conclusions from the absence of fossils. One can only say that they are invariably absent where they should be absent on the existing theory of descent, though not invariably present in the hitherto investigated strata of periods where, according to the theory of evolution, the animals which would have left them lived somewhere on the earth. The argument from the absence of a given type is therefore never conclusive. But it is admissible, as the negative evidence of previous good character is admissible in a criminal trial. One important point in assessing the value of this negative evidence is the frequency of other fossils. If we find no mammals among a rich deposit of

amphibians, insects, etc., this means more than if we find none in a rock with few or no other fossils. Now if there were fossils "linking up the great phyla" these would be found mainly before the great phyla came into existence, i.e. before the Cambrian, when protozoa, sponges, coelenterates, brachiopods, echinoderms, molluscs, annelids, and arthropods were already in existence. But fossils are very rare before the Cambrian, though enough exist to make it clear that there were living organisms before that period, as there must have been if these various groups came from a common stock. Hence the argument from an absence is very weak. If you examine my library containing two thousand books and find none in Italian there is a good presumption that I do not read that language. If you examine the three books found in my suit-case and find none of them in Italian, the inference is much weaker.

(7) As it is not clear what you mean by the word "officially" I cannot tell you of any mediaeval university where it was officially taught that the planetary motion was due to angels. But the theory must have been discussed in them all, for St. Thomas considers it at considerable length, e.g. in Chapters 70, 90, 91, and 92 of Book II of the *Summa contra Gentiles*. He left the question open: e.g. in Chapter 90, "for the heavenly bodies (if indeed they be animated) have a circular movement," and in Chapter 70, "Hence Augustine says (*Enchir.*) 'Nor do I consider it as certain whether the sun, moon, and all the stars belong to the same company,' i.e. of the angels; 'although some think them to be bodies endowed with light, without sense or intelligence.'"

Aristotle thought that each of the circular movements into which it was believed that the planetary motions could be resolved was due to a separate intellectual substance, and mediaeval philosophers identified these separate substances (κεχωρισμενα) with angels. Given such astronomical ideas it was reasonable to trace back all movement to an intelligent prime mover.

On the whole, I think it fair to say that, owing to the great respect paid to Aristotle's opinions, most mediaeval philosophers would have regarded the theory of angelic movers

as very plausible. You accuse me of "trotting it out." I can only say that I have trotted it out less often than did St. Thomas.

(8) Yes, I agree that every effect requires an adequate cause, though I might not agree with your definition of the word "adequate."

(9) No, I do not agree that intelligence in the effect implies intelligence in the cause, though this may possibly be the case. I am not convinced. Of course if your arguments in your last letter are correct, Christianity is demonstrably false. You write of St. Thomas Aquinas that "he knew there can be nothing in the effect which was not present in the cause, a truism which you (J. B. S. Haldane) deny." Now you say that God is the cause of the world. But there is evil in the world. Therefore there is evil in God. Unfortunately I cannot use this argument in such a simple form, because I am not convinced of your major premise.

But you can't have it both ways. If intelligence in the world implies intelligence in its cause, then evil in the world implies evil in its cause. If the first cause had (or has) no trace of evil, I am entitled to suggest that if there was such a cause it had no trace of intelligence either. The argument that evil is a necessary concomitant of free will is no use, for St. Thomas in Chapter 92 of Book IV of the *Summa contra Gentiles* says that the blessed in heaven, though preserving their free will (Chapter 95) can never will evil. Hence an omnipotent being could have created them in that fortunate condition, without the previous existence of evil.

Your questions answered, I proceed to your other points, which I shall take up in order. There is an antithesis between praying to God in times of cholera (not plague) and boiling your drinking water. The more you rely on one method, the less you are likely to rely on the other; and unfortunately Christians have scriptural authority for not boiling their drinking water. Jesus is reported (Mark vii. 18) to have said: "Do ye not perceive that whatsoever thing from without entereth into a man, it cannot defile him; because it entereth not into his heart, but into the

belly, and goeth out into the draught, purging all meats." On the basis of this and similar texts, Christians gave up a number of valuable Jewish hygienic laws, along with a lot which were useless. Actually it is an unfortunate fact that the cholera bacillus, after being eaten, may remain in the body for a considerable time, and kill it. Only with the recent revival of materialism have people begun to realize that while the above text was perhaps true enough as regards psychology, it was far from true as regards hygiene.

Again, we have the text to which I referred already, which authorizes faithful Christians to drink poison. It is rather bad luck for you that you did not agree with its obvious interpretation, since I read that an American preacher has just allowed a rattlesnake to bite him, and survived the process. Finally we have James iii. 14: "Is any sick among you? Let him call for the elders of the church, and let them pray over him, anointing him with oil in the name of the Lord: and the prayer of faith shall save the sick. . . ." If you believe this, as the "peculiar people" in England do, there is no need to boil your water in time of cholera. On the contrary, it shows lack of faith. Hence the rude remarks made by coroners, who are less consistent Christians, when these people let their children die without calling in a doctor.

Your eminent Catholic scientists would impress me more if I were not at this moment supporting a colleague who cannot return to a certain European country because he has ceased to be a Catholic, and therefore cannot get a job. Copernicus would have been very lucky to escape burning alive had he ceased to be a Catholic. Pope Gregory's claim to be a scientist on the basis of the Gregorian calendar is analogous to that of Julius Caesar, who ordained the Julian calendar which Gregory superseded. If Gregory had been a better scientist he would have adopted the corrections discovered by Omar Khayyám five centuries before his time, which give a better calendar. Mendel is not such a clear case as you think. His biographer, Iltis, on what seems to me inadequate evidence, regarded him as probably a freethinker. Pasteur was of course a fervent Catholic. Note that I did not say that all scientists were inevitably

atheists. I merely say that the spread of science inevitably leads to the spread of atheism.

It is a pity that it is too late to ask you for your evidence that the majority of scientists are theists. The only statistical study of this subject known to me which could answer the question is Leuba's recent questionnaire answered by 75 per cent of two thousand three hundred American scientists. They were asked to accept one of the following statements:

(A) I believe in a God to whom one may pray in the expectation of receiving an answer. By "answer" I mean more than the natural, subjective, psychological effect of prayer.
(B) I do not believe in a God as defined above.
(C) I have no definite belief regarding this question.

30 per cent accepted (A), 56 per cent (B), 14 per cent (C). This result[1] is not conclusive, but suggests that the theism of American scientists, at least, is rather sparse.

Darwin, you write, was a convinced theist. In Vol. I, p. 304 of his *Life and Letters* I find the following statement of his religious opinions: "In my most extreme fluctuations I have never been an atheist in the sense of denying the existence of God. I think that generally (and more and more as I grow older), but not always, an Agnostic would be a more correct description of my state of mind." If this attitude is convinced theism, I think it likely that most scientists are theists, though perhaps not quite convinced.

You still do not understand my point about authority. In the book you mention I give references to a number of scientists, including myself. But except in Chapters I and VI, where I am trying to state problems rather than prove conclusions, I do not ask anyone to believe a controversial statement on authority. Or if I do, I am wrong. My references are to statements of detailed fact, or mathematical arguments. Both of these can be checked by subsequent workers. We know the reasons which made Ampére formulate his conclusions as to the relation between electricity and magnetism. We can repeat his experiments.

[1] *Harper's Magazine*, August 1934.

But we do not, at least I do not, know why he was a Catholic. Very likely because his father was executed by anti-Catholic revolutionaries. If he gave any novel facts or arguments for Catholicism I should be glad to hear them; if not, his adherence to Catholicism is a slender argument for its truth. Various people have been impressed by my theories about natural selection. I have never, I hope, quoted their remarks in support of those theories, and do not intend to. In so far as they are true they had better stand by their own merits. In so far as they are false, they should not be supported by authority.

As to St. Thomas, I am not unduly impressed by your authorities, because so much philosophical writing consists of attempts to prove that former philosophers held the opinions of the author. The same tendency is at least as highly developed in theology, in the numerous different interpretations of scripture. Fortunately St. Thomas, as I have said before, was an unusually clear writer, and stands in little need of such reinterpretations.

I am interested to learn that God is only self-explanatory to God. I could wish that, if he exists, he were a little more self-explanatory to man. I am still more surprised that Plato used the word "opposition." I always thought he wrote in Greek. When he described things as being and not being that is my idea of a self-contradictory statement. You also say that Plato "foisted on us the conception of an eternal mind too dignified to have any truck with vulgar matter." Here is what Plato makes Socrates say in the second book of the Republic:

"Neither can God, since He is good, be the cause of all things, as most people say, but He is responsible as regards men for a few things, but for many He is not responsible; for our good things are much rarer than our evil things; and no one else is the cause of our good things, but of our evils we must seek some other causes, and not God."

Actually it seems that Plato's opinion varied, but on the whole he regarded God as engaged in a not completely successful attempt to organize matter. I cannot see that Plato's sexual habits or those of his friends are particularly relevant. Almost the whole of Catholic theology is the work

of men who did not live normal sexual lives, but I can find better reasons than that for attacking it.

I did not say that I believed in an eternal mind. I said there were strong arguments for it. There are also strong arguments against it. I have never defended mathematical conceptions which I describe as incomprehensible and self-contradictory. I said that you might so describe them, which I humbly submit is not the same thing.

I regret that it is too late to discuss the "pros and cons" of an eternal and changeless mind. It may be that such a phrase is meaningless. If not, it is surely reasonable to expect that, just as our minds show their existence by facts localized in time, namely, our acts of will, such a mind would show its existence by facts not localized in time, e.g. "$12^2 + 5^2 = 13^2$," or "It is good to aid other sentient beings in distress." Such arguments, it seems, do not appeal to you. If you can convince me that they are invalid you will probably convert me to complete atheism. Perhaps such facts may exist in their own right, so to speak, without any mind to know them. But I do think that the existence of a changeless mind solves certain problems, if it creates others.

My phrase "capable of verification or otherwise" was an unfortunate consequence of my dislike of repeating the phrase "which can be verified or shown to be false." It was intended to mean the same thing, and as you find it ambiguous I am glad to clear up the point. I am afraid that your thesis about the decline of sexual morality is open to question. For example, in Russia prostitution is alleged to have been abolished, and has certainly been greatly checked. In the course of a fortnight's stay in Moscow and Leningrad, which included a lot of solitary walks through streets after dark, I was never accosted by a prostitute or a pimp. I know of no other capital cities where this is so. The supporter of Christian sexual morality must balance this achievement against the facility of divorce, which he doubtless regards as deplorable. I think that many of the Victorian agnostics would have regarded the balance as favourable. Similarly, though I have no intention of defending everything that goes on in atheist

Russia, I should be very glad to compare its standards of mercy with those of Christian Russia, if time permitted.

In the same way I should have liked to compare the standards of compassion, as shown by the provisions made for misfortune and by the criminal law, in modern England, which is fairly irreligious, with those which prevailed when Christianity was compulsory in it. At the present moment Christian apologists concentrate on Russia. It is very instructive to read their prophecies of the moral and political downfall of France made in the first decade of this century, when that country had a series of vigorously atheistic governments.

As for Mr. Wells, he is animated by a laudable desire that "feeble folk" should not be brought into existence in the future. That is not the same as demanding that they should be painlessly extinguished. You hold that monks should not beget children. I have never accused you of suggesting that all children begotten by monks should be chloroformed at birth. Personally, I do not altogether agree with Mr. Wells's outlook, and find the best examples of scientific humanitarianism not in his theories, but in the practice of the medical profession, whom, when it suits you, you produce as an example of scientific intolerance. In every great hospital to-day you find doctors giving free treatment to patients who are often "dreary and unattractive," and sometimes dying as the result of infections contracted while doing so.

We next come back to the "missing link" question. You say that there is no "definite lineage series of evolving types connecting reptiles and mammals," but only "a few isolated specimens which you find some difficulty in classifying." Broom, in *The Mammal-like Reptiles of South Africa* lists 1,200 skulls, belonging to 350 different species. Is 350 a few? Of course it is only a small fraction of the total number of species preserved in the Karroo, which he estimates at over 20,000. Some of these 350 seem to many palaeontologists to form fairly definite lineages. Of course they may be wrong, but I should like to know why.

You say that the difficulties of accepting evolution are greater than those of accepting the roundness of the earth

or planetary gravitation. I don't agree. The doctrine of the earth's roundness was combated for centuries, largely because common sense appeared to deny that men could live upside down. Evolution is being accepted remarkably quickly, considering all its consequences. I can only disagree with you that there is no lineage series "linking up the great orders" (known to zoologists as classes), such as fishes, amphibians, reptiles, and mammals. Why not read Broom on the subject? You might regard him as unprejudiced, as he happens not to be a Darwinist, and inclines to the belief that evolution was guided by intelligence, facts which do not prevent his colleagues from taking his work very seriously.

Next come your definitions. You say that "chance" means "the product of physico-chemical forces undirected by intelligence." This is not what I mean by chance. For example, I do not think that I stand a sporting "product of physico-chemical forces undirected by intelligence" of convincing most of our readers that your definition is faulty. But I do think I stand a sporting chance. On the contrary, I think physico-chemical forces undirected by intelligence make for considerable certainty. I have much more faith in predictions of how the moon will behave than in how even the most intelligent man will behave.

You still won't define minor evolution. An example is not a definition. I deny that a lizard is of an entirely different type from a bird. They have a lot in common, more than a frog and a bird. And *Eohippus* and the horse were very different. Apart from his small size, *Eohippus* had four toes on his front feet, pointed canine teeth, and much simpler molars than a horse. He was much less like a horse than a baboon, let alone a gorilla, is like a man in appearance. He was also far less like a horse than a reptile such as one of the Ictidosauria was like a type classed with the mammals, such as one of the Triconodonta, at least as far as we can judge by bones and teeth (and in these cases we have nothing else to judge by).

Huxley's sentence meant a great deal more than you say. He meant that during the mesozoic and later epochs the crayfish's ancestors had been evolving from ancestors like

crayfish, and not, for example, like sandhoppers, crabs, or wood-lice.

My analogy of the dog has not quite the significance you attach to it. It is as follows. Just as all dogs in England are someone's property, so all animals whose life-history has been investigated are the progeny of others. Hence there is a strong presumption that the dog you find is someone's property, and that the animal whose fossil remains I find was produced by another animal, not created by God. I think it is up to you to prove the exceptional case.

You call spontaneous generation a fantasy, without realizing that creation is an equally unproved hypothesis. You have never seen life created, I have never seen it spontaneously generated. But whereas you believe in creation, I merely regard spontaneous generation as the least unlikely of a group of theories, which include the creation of life and the eternity of life.

Now for the upward trend of evolution. You use the phrase "if survival was what nature aimed at." If nature aims at anything, she is presumably a person, a view which I reject. The survival of the fittest does not explain the arrival of any novelty unless there has previously been variation. But variation is an obvious fact. Many organisms produce offspring larger than themselves. If these are to survive they must also vary in the direction of greater complication. Some will sometimes do so. Hence there is a tendency for large organisms to be more complicated than small.

Darwin did not attempt to explain the origin of sex. His followers, such as Darlington, have made a very real attempt to do so. He did not attempt to explain the origin of life. I suppose that if I wrote a book on the origin of the European nations you would blame me for not dealing with the origin of civilization or that of man! The origin of species is a big enough problem for one writer. Nor does Darwin's opinion that the doctrine of creation was grand prove that he considered it true.

I wish you would not credit me with the claim to have made a new species. As you knew when you did so I make no such claim for myself. I do make it for others.

Darwin's views on animal patterns have been shown to be incorrect in some respects. It appears that a good deal of the detail in a butterfly's wing, for example, is due to the simple interplay of physical and chemical processes such as we see in the beautiful parts of inanimate nature. It has been shown that certain female birds are more attracted by males when a few extra bright feathers are gummed round their necks, so there is some factual basis for his theory, but I do not think many biologists regard sexual selection as anything like as important an agency of change as natural selection.

I was unaware, until you told me, that any of the apes (i.e. tailless monkeys), which are our nearest relations, have blue behinds. I thought they were only found in the monkeys with tails, which differ from us and the gorilla, chimpanzee, orang, and gibbon in many respects. I see no reason to suppose that any of our ancestors possessed this ornament. If evolution were always, as you suggest, a progress from the simple to the complex, the taste of our second cousins (so to say) would perhaps be surprising. But as you know, and as I have pointed out *ad nauseam* in my various books, it is at least as often in the direction of simplification.

Actually I wish you had brought up the question of beauty earlier. I suspect the word of covering a number of pretty different qualities which rouse somewhat similar emotions in us. Thus intellectual beauty, aesthetic beauty, sexual beauty, and moral beauty may have very little in common apart from the quality of this emotion.

The sense of beauty, as we see it in animals, seems to have evolved in a rather small number of directions. Thus many vegetarian birds and insects like bright colours, musical sounds, and sweet smells and tastes. A number of carnivores both among mammals, birds, and insects, prefer duller colours, unmusical sounds such as the cat's howl and the gull's scream, and rank smells both in their food and their mates. Man oscillates between both, the vegetarian tastes being more respectable.

One can interpret such facts (if facts they be, for I claim no special knowledge here) in two ways. One can say that

mind could only evolve along certain lines, as for example eyes or respiratory pigments could only evolve along certain lines. Or one can say that there are certain universals, of which a given animal species can only apprehend one, while man can to some extent apprehend both. These are really two ways of saying the same thing.

I cannot see that the two types of explanation conflict. One is historical, the other in the terms of the complex system which is the end production of evolution. Both are perhaps correct. The British constitution is largely an undesigned product of historical growth. A full account of it includes both its growth and its actual functions. It may be that our appreciation of music originated in the way you mention, and that yet in appreciating music we apprehend universals. Our knowledge of physics originated from the practice of weighing and measuring for purposes of trade and taxation. That does not mean that physicists are only interested in making money.

I think that the various universals or eternal objects form a system which at least presents certain analogies with a mind, but I may very well be wrong. You seem to think it is a poor argument for the existence of an eternal mind.

In any case it is clear that a lump of matter may alter so as to be qualified by a universal which did not qualify it before. When salt crystallizes it may form approximate cubes. This does not mean that the eternal facts of geometry were an efficient cause of its crystallization. When the Wetterhorn was eroded it became beautiful, as the crystal became cubical. This does not mean that eternal beauty caused its present form.

When you appreciate the Wetterhorn, the same universal, aesthetic beauty, is in you both, though of course in a different way. This implies a kinship between you and the Wetterhorn, which may be described in two manners. Your mind, I suggest, is a physical object which is often occupied with emotions such as hunger and other biological urges, to which it conforms as a result of natural selection, among other things. But in so far as your mind is not so occupied it may be expected to mirror the inner nature of matter in general, and to be impressed by objects which show that

nature in a simple way. We may also say that just because our minds are not immaterial they are responsive to the universals embodied in other material systems. If you really are an immaterial being your feelings are much harder to explain.

At last I begin to understand Dewar's figures. If any fossil is like enough to a living animal to be put in the same genus with it he assumes that the genus existed from the time of the discovery of its first fossil member up till now. This is not unreasonable if one believes in evolution. But it is a quite gratuitous hypothesis if one believes in creation. A mole-like fossil was found in the oligocene (not, I think, the common mole, but something like enough to it to be put in the same genus, as the donkey is included with the horse). Now if you believe in creation, and also that the geological record is fairly complete, the only reasonable deduction is that a sort of mole was created in or before oligocene times, and that the Almighty had no further use for its services during the pliocene, but made another one fairly like it in recent times. Apparently if two animals are like enough to be put in the same genus, we must assume missing links between them, but this is mere dogmatism if they are only like enough to be put in the same family. If you once admit creation there is absolutely no valid reason why God should not have created moles a dozen times over. The odd thing is that species were created at times and places which agree with the evolutionary theory. I find this idea very odd indeed, and I fear that we shall have to leave it at that.

I warned you against Professor MacBride's authorities. Here is a passage from "the great American systematist Sumner":[1] "They [the preceding paragraphs] may also make it clear why I was, at the outset, sympathetic with the Lamarckian explanation of the phenomena of geographic variation, and why I was skeptical of the attempt to interpret all hereditary characters in terms of Mendelian genes. To what extent the results of these investigations have forced me to change my views will appear later." I also enclose a later paper by him, in case you think I am quoting unfairly.

[1] *Bibliographia Genetica*, Vol. IX, p. 4.

Sumner at one time held opinions like those of Professor MacBride. He changed them because he started breeding *Peromyscus*, instead of merely studying specimens, like most systematists. The reader has to decide between the opinion of systematists who have gone in for extensive breeding and those who have not. Such British plant systematists as Turrill and Marsden Jones, who have not merely "given their lives to classifying species," but also to breeding them, interpret the differences found in nature in terms of genes. Sturtevant, a prominent geneticist, devoted some years to the systematics of *Drosophila* with such effect that he increased the number of American species from thirty-four to sixty-nine. He compared their differences to those arising within a species by mutation, and wrote: "We may conclude from these data that mutations do frequently bring about changes similar to those found in wild species. . . . The picture of evolution that this analysis leads to is in effect not so very different from that which Darwin drew. Species change gradually, by the slow accumulation of new variations."

I can quite understand that museum keepers often (though by no means always) agree that mutations have had no share in species formation. But I cannot understand how Professor MacBride has overlooked Sumner's rather spectacular recantation of Lamarckism. I am also surprised that his conclusions are based on a study of mutations at the John Innes Horticultural Institution. Apart from mutations in variegated plants, which no one supposes to have any evolutionary importance, I cannot think of a dozen mutations known to have occurred there in the last twenty years. The research policy of the institution has not been directed to the study of mutation, but mainly to the analysis of genetical differences already in existence.

No reference is given to Mohr's statement, but if mutations are characterized by damage to vigour it is unintelligible to me why some should lead to a lessening of mortality at all stages of the life cycle. I enclose a reprint giving details of such a case. I could bear a loss of vigour which served to prolong my life. Why a change such as that which gave us the long-haired rabbit or the crested

fowl should be called "cramping or distorting of the powers of growth" I cannot imagine. A change, no doubt, but certainly not a cramping, and why a distortion? Is not the use of this word suspiciously like that of "abortion" in connexion with *Archaeopteryx?* Some mutations no doubt deserve this term, but what is there cramped or distorted about a Shirley poppy or a black panther? And what is there malign in the influence which produced the blue primrose or the beardless wheat?

The statement that "So long as the conditions which produced the mutation continue, it will be faithfully reproduced" is incorrect. Where mutations are due to X-rays or heat a continuation of these conditions leads to further mutation, i.e. unfaithful reproduction. In order to get faithful reproduction it is necessary to return to more normal conditions. If Captain Cook's pigs had not reverted towards the wild boar in fifty years it would go far to disprove Darwinism. It is obvious enough that in the New Zealand bush natural selection would pick out such characters as are suited to the wild condition, and as the domestic pigs were not a pure line variations were available on which selection could act.

In the case I quote I have certainly not assumed what I intended to prove. Muller found that X-rays cause the normal type to mutate to abnormal types. It was later found that the same agency causes these abnormal types to mutate back again, which (*pace* Professor MacBride) they do not do otherwise except with extreme rarity. Thus Timoféeff-Ressowsky in 1933 irradiated mutant flies. In 288,961 progeny he got eighteen mutations back towards the normal. In 139,234 progeny of untreated controls he got no back mutations. If you or Professor MacBride think that there was no causal connexion between the X-rays and the back mutation in this and similar experiments, I must leave it at that! You say that "in reality they are not mutations at all but reversions." I don't much mind. They occur under the same conditions as mutations; and their products, like the products of mutation, exhibit simple Mendelian inheritance when crossed with the type from which they originated. If they are "certainly not due to

fresh damage" I wonder why it is so certain that the original mutations were due to damage.

Professor Woltereck has made it probable that new species of water-flea have not originated by a single jump. Such a mode of origin is exceptional. Darwin believed that it never happened. But if such workers as Müntzing and Clausen were wrong when they claimed to have made new species of labiates and violets, is it not curious that no one has attacked their specific identifications? Because water-fleas do not evolve in jumps, I fail to see why violets should not.

Actually the citation is more instructive than you realize. Water-fleas generally reproduce by parthenogenesis. The unfertilized females lay eggs, and it is only occasionally that males appear. Now it is generally thought that sexual reproduction plays a very important part in evolution by allowing all kinds of combinations of genes, some of which may be advantageous. Hence the rate of evolution is probably greatly slowed down in species which have adopted parthenogenesis. Indeed there is reason to think that many of them are "dead ends" incapable of much further evolution. Even with this handicap Woltereck thinks that water-fleas have managed to originate new species in four hundred thousand years, which is less than one thousandth of the time since the earliest fossiliferous rocks (dated from radioactivity). Why, even at this rate, it should take billions of years, i.e. over two million times as long, to make a new genus, you have not told me, since systematists are constantly disputing as to whether or not two species belong to the same genus.

Once again I have already stated that I have never made a new species, or claimed to do so. I deny completely that those best qualified to judge have not been converted. Clearly the people best qualified to judge are those who are both systematists and have done genetical research on mutation. Professor MacBride mentions no such persons except Sumner.

I think the whole matter will be clearer if I explain its history. In the first ten years after the rediscovery of Mendel's paper work was mainly devoted to the analysis

of innate differences within species, and naturally enough investigators tackled the big differences first, such as the difference between a normal and an albino rabbit. These differences are greater than those between nearly related species. Moreover, many of them are so large as to be harmful. For any *large* change, unless it involved one of those wonderful coincidences in which you say I believe, is likely to lower fitness in some way. For example, many people would be benefited if their eyes could be lengthened or shortened by a millimetre (mine want lengthening), but none would benefit by a change of an inch. Hence a study of the more obvious mutations suggests pathological phenomena of no evolutionary importance.

It was not till 1923 that Gonsalez laid this bogy by showing that some mutant forms lived longer than the normal type of the species. Meanwhile Lotsy, a Dutch botanist who has made his name as a systematist, became unsatisfied with existing criteria of species, and started crossing them. He found that the differences between species were often due to numbers of genes like those which arise by mutation. He also thought that hybridization might be a cause of the origin of new species, though no one supposes that it is the only cause; and there is as yet no evidence that any animal species has arisen this way, though I think it likely that *Presbytis cruciger*, a Bornean monkey, did so, to take a single example. On the other hand, the evidence regarding plant species is overwhelming. To take the case of Müntzing's work on *Galeopsis*, already cited, one of three alternatives must hold, in your opinion:

1. Müntzing is a liar.
2. His identifications of species are wrong. This seems rather unlikely, as the labiates are not a difficult family to identify, like the rushes, and he worked in an institute with a number of good botanists.
3. *Galeopsis speciosa* or *G. pubescens* should be put in the same species with *G. tetrahit*. Can you tell me of any botanist who has suggested that the distinction is invalid?

Anyway, who are "those best qualified" who have read Müntzing's paper, and do not agree with his conclusions?

You end up with the remark that Darwin's view "that the main agent in the evolutionary process was the natural selection of favourable variations" is completely discredited to-day. Well, of course you don't believe it, and I do, which will discredit it completely in the eyes of some people. Let us leave it at that.

. . . . .

In one way this book has been a disappointment to me. I had hoped, as perhaps readers of your first letter had hoped, that, after you had attacked my position, you would defend your own. I should never have begun this correspondence had I not hoped that I could induce an intelligent Christian to tell me how a perfectly good and almighty creator could have made a world containing so much evil, and how divine omniscience and omnipotence are to be reconciled with human free will. For those are my main intellectual difficulties in accepting the idea of God, which must be overcome before we even begin to weigh the case for Christianity against Islam and Judaism, or for catholicism against the various forms of protestantism.

I fear that I shall never get an answer to these questions, because they have no answer. I do not blame you for not answering them. And perhaps this correspondence will be more impressive because you have not.

Yours very truly,

J. B. S. HALDANE.

XXX.

SUMMING UP

November 14, 1934.

My Dear Haldane,

It is not easy to reconcile your suggestion that it is "sound tactics" for me to concentrate on evolution with your view that the evidence for evolution is almost as strong as the evidence for the roundness of the earth, for it would certainly not be "sound tactics" to suggest that the earth was flat.

Why do you insist so eloquently that I should answer questions which I have already answered, and defend views which I have already repudiated? I have explained (twice) that I agree with St. Thomas that there is no valid philosophical argument against an infinite regression of movers, and I have conceded (once) that design for evil may legitimately be used as an argument for an evil intelligence. May I remind you that an argument is not necessarily conclusive because it is legitimate?

As we have already passed the agreed date for delivery of the manuscript, and exceeded our agreed length, I shall make no comment on your new citations from St. Thomas, and indeed must leave much of your letter unanswered. He is, as you say, a clear writer, and yet you usually misunderstand and misinterpret him. The reader will remember that I have always been able to cite distinguished philosophers in support of my interpretation, but you have never cited anybody in support of yours. God forbid that I should imply that experts are always right and the man in the street always wrong. But as you have framed the hypothesis that "Haldane is the only person who knows what St. Thomas meant," you will, if true to your principles (see page 4), "try your hardest to disprove" this somewhat startling theory. I do not think you will have to try very hard. Your frequent appeals to the authority of St. Thomas invite the reminder that though Catholics regard St. Thomas as one of the master intellects of history, they need not believe all that he believed, or adopt all his arguments as their own.

Your reference to Mendel is characteristic. You have too much sense to identify yourself with that baseless libel, but you don't apparently mind creating prejudice, and, of course, if Mendel wasn't a freethinker, he ought to have been.

I do not believe that the case for theism is strengthened—it does not need strengthening—by the fact that Mendel was a Catholic, nor should I think that the case for atheism was strengthened had Mendel been a freethinker. I have mentioned at random a few of the long list of great names which the Church has given to science, not as an argument for Catholicism, but as an answer to your odd belief that as science spreads atheism increases.

I am afraid that as we are both leaving England, and as the book must go to press now, I shall not have the chance of sending in your criticisms of Professor MacBride's views to Professor MacBride for his rejoinder.

It is untrue that we have been occupied exclusively in this correspondence with attacks on your position, for you have attacked at length my belief in God, in miracles, and in the reality of certain supernormal phenomena. But even if this were true, that your beliefs had been the theme of this correspondence, you would have no just cause for complaint. Father Knox was content to defend Catholicism in his controversy with me, and ventured on no counter-attack. Apart from a brief reference to Mr. Joad's philosophy, I contented myself with defending Christianity in my controversy with him. I do not see why you should not be prepared to do what we have done, and to submit your own creed for cross-examination.

It is ungenerous of you to imply that I am trying to evade the difficulties of my position. The greater part of my book with Joad was devoted to the problem of evil which I am now accused of dodging. At an early stage of this correspondence I pointed out that it would be impossible to cover the points at issue in one volume, and suggested that we should co-operate in a sequel. You declined and are entitled to decline this offer, but a man who has neither the leisure nor the inclination to continue the controversy should not accuse his opponent of running away.

The fact is that the stock blend of sneer, sniff, and travesty upon which most secularists depend when they wish to say something about the Church, has misled people into believing that these great issues can be adequately discussed in a few pages.

We should need the best part of a book to discuss the problem of evil. I should have to begin by clearing away misunderstandings, e.g. the usual confusion between physical and moral evil which is perhaps responsible for your answer to my ninth question. Pain is in creation (the effect) because it is in God (the cause). God "was bruised for our iniquities." But you should not imply a comparison between moral evil which is negative and intelligence which is positive. A bad man is a man who lacks a positive thing, —goodness. Badness is a defect, *malum est enim defectus boni*, as St. Thomas remarks, and as I have never maintained that what is present in the cause must be present in the effect, your reply to my ninth point is irrelevant. I am surprised that so accomplished a Thomist as yourself should not have alluded to St. Thomas's treatment of the question, "Is God the cause of evil?" Look it up.[1]

Having cleared up this point, I should then show that the problem of evil is insoluble excepting on Christian lines. This would involve a discussion of the Resurrection and of the Christian attitude to suffering. Here perhaps I might count on a slightly more sympathetic hearing from you than from most readers in this pain-dreading age, for one of the things which I most sincerely respect in you is your own personal reaction to pain.

I have not the least desire to run away from the problem of evil which, incidentally, I discussed at some length in my last book, *A Saint in the Slave Trade*. Space has been the difficulty, since we both prefer to discuss a few issues thoroughly rather than many issues superficially. You have complimented Catholics on arranging our arguments in a logical order, and yet you grumble because I follow St. Thomas in proving that God exists before discussing his attributes. You would waste little time arguing about the nature of electrons with a man who denied that electrons

[1] *Summa*, I, Q. xliv

existed. Surely the logical procedure is to begin by proving that nature is not self-explanatory, and that the universe as we know it is inexplicable excepting on the hypothesis of an uncaused cause, *et hoc omnes intelligunt Deum*, to quote St. Thomas.

As a Christian I am flattered that your "main intellectual difficulty" in accepting the belief in God is your difficulty in accepting what Christians believe about God. I do not consider that this attitude is logical.

If you could disprove the Resurrection I should cease to be a Christian, but I should not cease to be a theist.

The sentence which you quote from Plato, and which I had intended to quote against you, merely proves that Plato at least did not regard the existence of evil as an argument against the existence of God. By the way, if you wish to evade criticism by a joke you must be consistent. The paragraph which opens with the reminder that Plato wrote in Greek concludes with the implication that Socrates spoke in English.

You do not dispose either of theism or of Christianity by raising the old difficulty of omniscience and free will, for many excellent Christians have believed, as Bishop Gore believed, that God limited his omniscience in order not to overrule the freedom of the will, and though no Catholic theologian would endorse this view, no Catholic would deny Bishop Gore's claim to be a Christian.

There are one or two minor points and one important question in your letters which I must answer in spite of difficulties of space. Of course prostitution has decreased in Russia. Why should people pay for what they can get for nothing? For quotations from *Pravda* on the filthy effects of promiscuity among the young, see *The Flight from Reason*, p. 123. I loved your red herring about H. G. Wells. I did not criticize him for wishing to prevent the birth of silly people, but for his attitude to the silly people that have been born. As to your remarks about doctors, I agree with them. There is probably no profession which gives more disinterested service to humanity. Nor is there anything inconsistent in believing this, as I most sincerely do, and holding that the Medical Council in one particular instance

made a bad mistake. You have tried and failed to prove that I am hostile to scientists. It would be even more difficult to show that I have a down on the medical profession. Incidentally, my father and my mother first met in a hospital on the staff of which he was serving as a doctor and my mother as a nurse.

You ask me to define major and minor evolution. I am glad to do so. I agree with you that an example is not a definition, and concede that you have a right to a better definition than I have yet provided you with. I had better begin by summarizing the accepted system of classifying organisms.

Organisms are divided into two main groups, the animal and the vegetable kingdoms. The animal kingdom again is divided into large groups known as phyla, each phylum is subdivided into classes, each class into orders, each order into families, each family into genera, each genus into species.

Thus the zebra and the quagga are different species of the same genus, the horse and the zebra belong to different genera of the equidae or horse family. The equidae belongs to the order of the *Perissodactyla*, which is an order in the class of mammalia, which in turn belongs to the vertebrate phylum.

I define major evolution as evolution which transcends, and minor evolution as evolution which does not transcend, the limits of the family.

As to the horse, it was generous of me to concede this as a proven case of evolution. All that the geological record tells us is that in the eocene there lived at least three different genera of horses, in the oligocene at least two other genera, in the miocene at least seven other genera. These different genera are not connected by a true lineage series. If you insist on the vast difference between *eohippus* and *equus*, I can only reply that there is no real evidence that *equus* is descended from *eohippus*, for the only coercive evidence for descent is a true lineage series of fossils.

Let me define again, more precisely, what I mean by a true lineage series. I do not mean a collection of fossils which are difficult to classify, and which cannot be arranged in anything approaching a pedigree. I mean a series of

fossils connecting an alleged ancestral type A with an alleged descendant type B by a series passing by *small* gradations from A to B—a series the members of which can be placed in a definite chronological order; a series the different members of which are slightly more like B than their alleged ancestors and slightly more like A than their alleged descendants.

I claim that there is no true lineage series uniting *any* of the families in nature.

Instead of appealing to the authority of Broom, will you be good enough to name the families which are said to be connected by what you describe as "fairly definite lineage series." I should, I confess, prefer even a short section of a "true lineage series" linking different families to your "fairly definite lineage series." The bogus pedigrees which abound in evolutionary literature prove that evolutionists attach a meaning of their own to the word "definite." The nature of the evidence which is the foundation of their "definite" statements does not dispose me to take very seriously the "fairly definite lineages" to which you refer. But I will read his book.

I wish that I had the space at my disposal to criticize the latest time scale based on radioactivity. It is easy to understand why you should wish to draw blank cheques on eternity. Instead, I must devote the rest of my time allowance to a brief summary of what I have tried to prove in this correspondence, leaving to you the last words in which you may also summarize the arguments which you have brought against my case.

. . . . .

Life is a choice of sacrifices, and something has had to be sacrificed for the advantages of a point-by-point discussion between two disputants. The orderly and balanced development of an argument, which is easy enough in an *ex parte* statement, is impossible in a correspondence of this description. I claim, however, that we have covered a great deal of ground, and I hope our occasional digressions will be forgiven us. Moreover, this form of controversy serves at least one valuable purpose, for it proves that the

Christian has no reason to fear debate, and no need to appeal from reason to intuition.

The modern convert to Christianity has to fight his way through a jungle of prejudice, and I do not therefore regret the space which has been devoted to discussing four of the principal prejudices which operate against an unbiased examination of the all but coercive evidence for Christianity. Those prejudices are as follows:

First Prejudice.—That Christians are committed to pre-Copernican astronomy, and that science has definitely disproved Christian doctrines. As you failed to reply to my challenge to name a single authoritatively defined dogma of the Catholic Church which has been disproved by science, I take it that we are in agreement on this point. My quotations from St. Thomas, St. Jerome, and St. Clement abundantly prove that theologians were more alive to the distinction between allegory and fact than some of their modern critics.[1]

Second Prejudice.—Arising out of the first prejudice is the belief that all those who accept the Catholic doctrine of the Eucharist "worship a biscuit," to quote your phrase, and believe that a few words of hocus-pocus by a priest will produce chemical changes in the aforesaid biscuit. This vulgar error is mainly due to the fact that the word "substance" as used by philosophers means something very different from the word "substance" as used by the man in the street.

The doctrine of Transubstantiation, which I have not yet defined in these letters, is an attempt to explain the real presence of Christ in terms of that "realistic" school of philosophy which has triumphed over the "nominalist."

This great mediaeval controversy turned on the fundamental question as to the nature and reality of universals.

[1] The only Bishop in the Royal Society appears to have contracted the habit so prevalent among popular scientists of making stupid and unsupported statements on this subject. In his book, *Scientific Theory and Religion*, he tells us (page 301) that the flatness and fixity of the earth were "taken over into the Christian creeds." Which creeds? On page 420 he describes as erroneous the "authorized teaching of the Roman Church" regarding the date of creation. What date did the Church authorize? He also refers to the "doctrine of the special creation of species." There is no such doctrine. Incidentally one of the most eminent of English mathematicians, Professor Whittaker, F.R.S., severely criticizes the mathematical theories that are put forward in this book by Bishop Barnes.

Here is an apple. It appears red to the eye, sweet to the tongue, resilient to the touch, and silent to the ear. These qualities of the apple which are discernible by the five senses are the "accidents" of the apple. But is the apple anything more than a group of impressions? No, said the nominalists, the word "apple" is nothing but a handy name for a collection of sensations. Yes, said the realists, there is a "real" apple, a universal which is independent of these particular manifestations. The "substance" of an apple is the "thing in itself" (the "real" apple, hence the term "realist"), and is imperceptible to the senses, and cannot be detected by any scientific tests. This substance—the noumenon of Kant—is the substratum which sustains phenomena. In the Mass the substance of bread is changed into the substance of our Lord's body, but the accidents, which alone are capable of chemical change, remain unaffected.

Third Prejudice.—This is due to a fundamental misunderstanding of the Catholic attitude to faith. In your second letter you made merry about our simplicity in holding that "faith is a virtue." And you proceed to draw a complaisant contrast between yourself and Father Knox, "who is bound to defend any statement found in the penny catechism." In a later letter you registered indignation because you believed, wrongly, that I had attacked your mental integrity.

You will probably be surprised that your sweeping attack on the intellectual integrity of bishops (see p. 14) should provoke a rejoinder. I was not present when Christ rose from the dead, and you were not present when a reptile thought that it would be rather nice to grow wings. My belief in the Resurrection is largely based on documents which are in existence. Your belief in evolution is largely based on documents which have disappeared, those missing volumes in nature's book to which the evolutionist appeals with such sunny confidence.

The trouble with you people is that you have managed to persuade yourselves not only that your own unflattering view of Christians is correct, but that the Christian reply would be, not to deny your charge, but to defend the

attitude which you falsely attribute to them. It is, for instance, a widespread illusion in your circles that Catholics have "got" to believe in certain doctrines because "faith is a virtue."

The Catholic, like other people, is bound by the rules of the institution of which he is a member. You cannot remain a fellow of the Royal Society unless you pay your subscription, and I cannot remain a Catholic unless I continue to subscribe to the defined doctrines of the Church. I have not "got" to believe in Catholic doctrines for the good reason that I have not "got" to remain a Catholic.

You would cease to be an evolutionist if a complete human skeleton were found in Cambrian strata, and I should cease to be a Catholic if it could be proved beyond all reasonable doubt that the disciples had stolen the body of Jesus and faked the Resurrection story. But you would be very much surprised if I told you that you had "got" to believe in evolution.

True, I accept on certain authority beliefs which I am not in a position to investigate for myself, but there is nothing irrational in accepting beliefs on authority provided that one can prove by reason that the authority is reliable. I have not been to hell and I have not been to Moscow, but I believe that both these unpleasant places exist. I believe in Moscow on the authority of people who have visited it, and I believe in hell on the authority of Jesus Christ who claimed to be God, and proved his claim by rising from the dead.

Faith is a virtue not because the Christian creed is difficult to believe, but because the Christian code is difficult to accept. Self-restraint is uncomfortable, and it is therefore tempting to rationalize one's dislike of the code and represent it as an intellectual objection to the creed. "Faith," said the schoolboy, "is believing in what one knows isn't true." If this were true faith would be a vice. Faith is a virtue, for it is often difficult to believe uncomfortable truths and to reject pleasant falsehoods, and in such cases faith represents the triumph of reason over sin, silliness, and conceit.

You implied in your earlier letters that bishops continue to recite creeds which they do not believe because they are

frightened of going to hell. The following quotation from the 1934 edition of Professor Karl Adam's magnificent book, *The Spirit of Catholicism*, may help to lighten your darkness on this point. The italics are mine. Page 227:

"On the other hand, the Church does not compel the Catholic to shut his eyes to the religious problems which arise, nor does she even permit him to do so. The Vatican Council condemns blind faith, and stipulates with the apostle[1] that the obedience of our faith should be in accordance with reason (*obsequium rationi consentaneum*).

"But it is especially here, in this extremest conflict between authority and conscience, that we realize again the intense earnestness with which the Church guards the rights of conscience, *even of an erroneous conscience.* It can scarcely be doubted that in most cases of lapse from the Church, the ultimate causes lie not in the intellectual but in the ethical sphere. . . . But it is important to note that Catholic theologians teach plainly and unanimously that the sometime Catholic is bound to follow his new attitude of mind, so long as it is a genuine and invincible conviction of conscience. Even though the judgment of his conscience be objectively false, and even though it be not in its genesis ethically irreproachable, *yet he is bound to follow conscience and conscience alone.*"

Fourth Prejudice.—This prejudice may be described as the Torquemada theme, which made a very early appearance in this correspondence.

"Cruelty and the abuse of absolute power," said Charles Dickens, "are the two bad passions of human nature." Dickens was more scientific than those who use these universal passions as a stick to beat any institution which they happen to dislike. Few institutions and few individuals can resist the temptations of absolute power, but if the Inquisition is an argument against Catholicism, the persecution in communist Russia is an equally valid argument against atheism.

Christ promised two things, first that his Church should endure to the end, and secondly that his Church should never teach error. He never promised that all Catholics,

[1] cf. Rom. xii. 1.

ecclesiastics or laymen, should be magically free from universal human passions, including the passions mentioned by Dickens.

Nothing is more irrational than to register indignation when the Church does certain things of which you disapprove, and to condone the same things when done by institutions of which you approve. Even if we Catholics were to concede as true everything that you could possibly say about the Inquisition, and every kind of libel unsupported by evidence about the Church in Ireland, or, say, Quebec, what would this prove? Merely that Dickens was right.

Severe critics have recently paid a generous tribute to the attitude of the Church during recent troubles. Our Catholic Press has whole-heartedly condemned the persecution of Jews in Germany, and no less whole-heartedly supported the magnificent stand which is being made by the German Protestants for spiritual autonomy. A strong alliance between all theists, Catholics, Protestants and Jews, to protest against all forms of religious persecution would have a tremendous effect. It is a thousand pities that the left-wing Press give the impression not of objecting to persecution as such, but merely of objecting when the victims are those with whom they are in political sympathy.

I cannot resist quoting in this connexion a leading article in the *Sunday Referee*, a paper which is not, so far as I know, in the pay of the Pope:

"The history of the Roman Catholic Church is almost the history of humanity itself.

"There have been periods when the Church became the instrument of tyranny and fanaticism.

"Now it stands in Europe as the one hope against the surging tide of dictatorship which is plunging the people into a darkness deeper than that of the feudal ages.

"The Pope is more than the head of the Church to-day. He has become the guardian and the hope of Western civilization."

If you reply that intolerance is integral to the Catholic position, you are guilty of the usual confusion between tolerance of error and tolerance of men in error. Catholics are expected, in the words of St. Augustine, "to love men

and to hate error." You will agree that a man need be neither a fool nor a fanatic to believe that the available evidence leads irresistibly to the conclusion that Christ proved his claim to be God by rising from the dead, and founded a Church which is supernaturally protected from teaching error. Thousands of men have sacrificed friends, position, and money to join the Catholic Church, and amongst these thousands there must be some at least who are your equal in intellectual acumen and in intellectual integrity. If, however, you once admit that a man need be neither a fool nor a fanatic to accept the Catholic claims, the claim that God speaks through his Church, you cannot deny to Catholics the right to draw logical conclusions from this premise, or complain if they draw a distinction between the truths which God has revealed and the truths which man has discovered for himself.

You tell me that when you frame a scientific hypothesis you try your hardest to disprove it. Your writings suggest, on the contrary, that you have accepted with simple faith the fashionable dogma of the day, evolution, and made no attempt whatever to disprove it. The scepticism, however, which you preach—but do not practise—is, I agree, fully justified by the rapidity with which scientific theories are reversed and discarded. But though it is our duty to receive with scepticism every theory put forward by scientists, "Speak Lord, for thy servant heareth," is the only logical attitude if we can prove by reason that God has spoken. Heresy, if the Catholic premise is correct, is rebellion against truths revealed by God. Disprove the Catholic premise if you can, but do not accuse the Catholic of intolerance merely because he draws logical conclusions from that premise. Heresy, if our premise be correct, is evil, but the individual heretic may be a near saint. May I quote again from Professor Karl Adam (page 192):

"We Catholics regard this Christian life, wherever it appears, with unfeigned respect and with thankful love. . . . And not merely a Christian life, but a complete and lofty Christian life, a life according to the 'full age of Christ,' a saintly life, is possible—so Catholics believe—even in definitely non-Catholic communions."

So much for prejudices. And now for the main issues that divide us.

You might have chosen *The Conflict between Science and Religion* as the title for this book, and I should have preferred *The Conflict between Science and Atheism*, which suggests that it is time that scientists of your way of thinking should invent some new label which we could accept to describe your sect, which achieved its greatest triumphs during the Victorian era, and which is now fighting a desperate rear-guard action. And until you can suggest something better, I propose to call you people after one of your great prophets, Thomas Huxley. The Victorian Huxleyites were prepared to accept any explanation, however fantastic and however unsupported by evidence, rather than admit the possibility of a supernatural explanation of apparently supernormal events. There was something heroic in their refusal to examine the evidence for facts which would have upset their theories. They had many affinities with the narrower Puritan sects, the same complaisancy and the same pulpit manner. It was no more surprising that Huxley should have published his essays under the title of *Lay Sermons* than that his grandson should preach *Religion without Revelation.* Even Wells seems to have been infected for a time by Huxleyism. He wrote, you will remember, a highly comic book in which he asked us to worship a god rather like Mr. Wells. Unfortunately Mr. Wells' accommodating god did not possess a robust constitution. And Mr. Wells, who seems secretly ashamed of this episode, has yet to build an altar to the stillborn god. The true Huxleyites are disappearing. Julian Huxley has made some very sensible remarks about psychical research, and you make concessions which would have shocked his grandfather. But if you are entitled to describe yourself as a Darwinist you are no less entitled to describe yourself as a Huxleyite, a concession which will please you.

A debate between a Christian and a non-Christian normally begins with a sniff or two on the subject of faith, and normally ends with the non-Christian appealing to fif in support of beliefs for which there is no evidence whatever. Thus Joad began good-humouredly by imploring me not

to play the trump card of faith more than once, and then proceeded to play trumps throughout the rest of the book. His only reply to the evidence for the Resurrection was an appeal to his own negative faith. He claimed, for instance, that it was reasonable to reject everything in the gospels which was "antecedently improbable." It is only fair to add that Joad's mind is by no means closed to the possibility of the supernatural, and I hope and believe that the massive evidence for Christianity impressed him more than he was prepared at the time to admit.

You opened with a flagrant misunderstanding of the Church's attitude to faith, and appealed again and again to the fif which assures you that something, such as spontaneous generation, for which there is no evidence, has occurred in the past, and that the links which continue to be missing will turn up in the future.

In this book I have maintained the following propositions:

1. Faith is grounded on reason and historic documents. Huxleyism is grounded on fif, and the dogma, for which there is no shred of evidence, that everything which takes place is explicable in terms of natural law. This book might be described as the conflict between Faith and Fif.

2. I claim to have shown that the evidence for the miracles at Lourdes and for the supernormal phenomena of the seance room which the Huxleyite rejected without examination is immeasurably stronger than the evidence for major evolution. I claim that the Huxleyite has no objective standard of truth, since he accepts the latter and rejects the former. The Huxleyite, for instance, jumped at Darwinism before the monk Mendel had provided scientists with some faint vestige of an excuse for accepting that amazing theory, but refused to examine the contemporary evidence for supernormal happenings.

3. I claim to have proved that evolutionary changes do not transcend the limits of the natural family, and seldom transcend the limits of the genus. "Only rarely," writes Vialleton, "has it been found possible to trace a genus step by step without artifice into an earlier genus; moreover,

when this can be done, it is never a case of two creatures essentially different in their organization, but of neighbouring forms of which the organization continues in the same line."

4. I have shown that the alleged imperfection of the geological record is an invalid argument. Dewar's argument on this point seems to me irresistible. The layman is apt to forget that though the odds against a particular specimen of a genus surviving in fossil form are very great, the number of specimens of any genus is also very great.

5. I accuse Huxleyites of a lack of candour. The case against theism is stated and refuted in Catholic text-books of natural theology. The fact that there is a case at all against evolution is suppressed in most modern books on evolution. The reader, for instance, will search contemporary evolutionary literature in vain to discover an adequate treatment of the difficulties summarized in Dewar's book *The Difficulties of the Evolutionary Theory*. You are a busy man, but you found time to read this book, and you will agree, therefore, that it cannot be dismissed as completely unimportant.

The disingenuous nature of certain favourite arguments in support of evolution might be cited by the uncharitable as evidence in support of the view that scientists were deliberately attempting to confuse the issue. But the true explanation is probably to be sought in the strange workings of crowd psychology. We have all been brought up to believe that evolution has been proved beyond all possible doubt, and this illusion muddies the springs of thought. As examples of such arguments let me mention the fact that evolutionists frequently confuse, as you have done, evidence which merely proves succession, a truth affirmed in Genesis, with the evidence which they need to prove evolution by descent. Again, evolutionists confuse, as you have done, a true lineage series with the existence of fossils difficult to classify. Finally, it is uncandid to imply, as evolutionists habitually imply, that evidence which suggests evolution within the limits of family or genus or species lends any support whatever to the belief that evolution has

transcended the limits of the natural family. The fact is that your belief in evolution is mystical rather than scientific. Why don't you drop arguing and appeal quite simply to religious experience? "If you knew what *Archaeopteryx* means to me, I think you'd understand."

6. Let me sum up. There are three possible theories of evolution; first, the theory of purely *natural evolution*, which breaks down on the geological record; secondly, *fundamentalism*, that is, that the different types were created *ex nihilo* by God, a theory which raises less difficulties than that of natural evolution, but which is difficult to reconcile with the existence of vestigial remains; thirdly, there is *Evo-creationism*—I don't in the least like this name, but until somebody suggests a better label I shall describe as Evo-creationists all those who hold, as Vialleton for one holds, that though natural evolution may explain all changes within the limits of the family, a supernatural creative force alone can account for the origin of life, and can alone offer a satisfactory explanation of the vast ragged gaps in the geological record. Direct creation out of nothing, or a supernatural and sudden mutation of existent forms, is the only reasonable explanation of the suddenness with which new forms appear. Of these two explanations, I prefer the second (Evo-creationism), for this explanation not only avoids all the difficulties of natural evolution, but also offers a perfectly satisfactory explanation of those vestigial remains which so strongly suggest evolution from simpler and earlier forms.

May I re-state in this summary that no Catholic is forbidden to believe in evolution? You probably know that the Rectorial Council of the Catholic University of Louvain sent Canon Dorlodot to represent them at the Darwin centenary. He made a most eloquent speech on that occasion, and paid a generous tribute to Darwin as "the interpreter of the organic world."

7. I have met your criticisms of the Thomist arguments for the existence of God, and I claim to have shown that nature is not self-explanatory, and that the evidence of nature forces us to accept the hypothesis of an intelligent Creator. I do not claim, in this correspondence, to have

proved that the Creator is either all-powerful or all good, for it is necessary to prove the existence of God before proceeding to discuss his nature.

8. I repeat that I have attacked neither science nor the scientific method. On the contrary, I have attacked the Huxleyites in general, and you in particular, for failing to apply the scientific method either to evolution or to religion. I believe with St. Ambrose that aspirations after truth are the workings of the Holy Spirit. The courageous experiments, for instance, which you have made on your own body are as much the product of a religious impulse as your belief in a world of absolute values.

I have tried to answer your genial pot-shots against Catholicism, but my letters must be read as a defence of theism rather than of Catholicism. I began this book just as I had completed my controversial correspondence with Father Knox, and I was not received into the Church until we had reached the middle point of our correspondence. I am just preparing a talk on "The Pleasures of Coat-Trailing," but though I enjoy enticing atheists into battle, I do not seek controversy with those who believe that the only hope for this distracted world is a return to Christ, and who worship Christ as God. I have stated, and may re-state in the future, my reasons for accepting the Catholic Faith, but I believe that this can be done without appearing to imply that the points on which Christians disagree are more important than the points on which they are in full accord. I owe a debt, greater than I can repay, to the example of Christians who are not Catholics, and I should be sorry if anything I wrote wounded those for whom I have such a deep affection and respect.

May I conclude by thanking you, which I do in all sincerity, for accepting my challenge, and for enabling me to put my case before your readers. We disagree on much. We agree, at least, in believing that controversy is valuable, and that hard hitting is as legitimate in verbal debate as in boxing. Our readers may have many grievances against

us, but at least they will not complain that we have attempted to disguise our views.

Allow me then to subscribe myself, in the pleasant diction of the eighteenth century,

Your most humble and obliged servant,

ARNOLD LUNN.

XXXI.

CONCLUSION

16, Park Village East.
Nov. 30, 1934.

Dear Lunn,

"Blank cheques on eternity." So you end your reply to my last letter. What a delightful example of anti-scientific invective. The evidence from radioactivity gives a definite age for the earth, of not much over two thousand million years. This figure is borne out by data from meteorites, from the eccentricity of the earth's orbit, the recession of the spiral nebulae, and so on. A blank cheque is a cheque with no figures on it. This cheque is far from blank. I wish you could realize that quantitative conclusions of this sort are reached by reasoning, such as you will find in Jeffreys' *The Earth*, and not from what you call "funny interior feelings." I fear that my wish is unlikely to be fulfilled.

It was agreed that this correspondence should cease by the end of October, and it is only fair to allow you the last word on certain questions, so I am not going to answer the new points which you now bring up, including the utterly fantastic statement that there is no evidence for evolution beyond the limits of the family. If you had wanted me to deal with this assertion, you should have defined "major evolution" a year ago. By the way, may I point out that your views on the taxonomy of the Equidae are highly individual, to say no more.

As to your list of prejudices, I believe that "prejudice" means an opinion held without examining the evidence. In so far as I ever held the opinions which you list, I hold them still, after examining the evidence which you have adduced against them. Nor shall I reply to your jokes about "Huxleyism." As I do not share the metaphysical opinions of the late Professor Huxley, these jokes would be irrelevant even if they were true.

Your arguments against evolution I must leave to our

readers. You will at least admit that I have met them in considerable detail. Your own arguments for the supernatural seem to amount to this, that there are more things in heaven and earth than are dreamed of in my philosophy. No doubt there are. I don't know how a carrier pigeon taken in a closed basket to Barcelona found its way home to Lancashire, a fact as mysterious as the knowledge possessed by mediums, and I think better attested. But I could admit all your "facts," and more, without finding any reason to believe in God, in the sense of a perfect being who created the world. Have you ever read the late Mr. Fort's books, such as *Wild Talents* and *Lo!* They contain the most impressive list of miracles, including, I think, a rain of roast beef before the time of aeroplanes, but the author arrived at conclusions totally different from yours or mine.

However, our readers will have to judge whether you have proved the various theses of which you give a list. The most important thing which I claim to have proved is as follows. A highly intelligent Catholic controversialist, when confronted with a critical analysis of St. Thomas's proofs of God's existence, postpones his reply, and then refuses even to answer so fundamental a criticism as that the Doctor states that God is a cause, but yet is not in any genus, and that no positive statements can be made about Him. Yet he can find space to tell me how his parents met, and even to produce a wholly new argument for Catholicism, the argument from the *Sunday Referee*. After reading it, I am still unconvinced that the Church to which Von Papen and Hitler belong is the ideal guardian of liberty.

In your first letter you suggested that we should collaborate in a book in which each of us should defend his own creed and attack his opponent's. I agreed, and later, as you say, refused to alter this agreement by collaborating in two books. I must assume that you have defended your own creed to the best of your not inconsiderable powers.

Now, it is impossible to defend theism of your type without contradiction. St. Thomas contradicted himself. You retort that Catholics need not believe all he believed. But you were going (p. 31) to "build your faith" on his arguments. Your own are of course equally contradictory. To

take a single example, you say that God is unchangeable and that He "was bruised for our iniquities." You write that the greater part of your book with Joad was devoted to the problem of evil. I quote your solution of it (*Is Christianity True?* p. 62): "To admit that my reason is inadequate to reconcile the existence of God and the existence of evil is not to abandon reason. Nor do I fall back on revelation: I admit that this problem is insoluble." St. Thomas's solution, to which you refer me, is somewhat better. But not very much so. You imply that he solved it. If there is one result which I sincerely hope from this book, it is that I shall induce inquirers into Catholicism to read St. Thomas and see for themselves what self-contradictory doctrines he taught.

Having refused to defend yourself on this point you proceed to sling mud. "It can scarcely be doubted," you quote, "that in most cases of lapse from the Church, the ultimate causes lie not in the intellectual but in the ethical sphere." I have known intimately one person who left the Church because she was convinced that it was unjust, but this is not what you mean. "Faith," you write, "is a virtue not because the Christian creed is difficult to believe, but because the Christian code is difficult to accept. Self-restraint is uncomfortable . . ." and so on.

I am glad that you have found it necessary to accuse your opponents of moral lapses. I certainly do things which the Church thinks wrong, but do not forget that the Church allows many actions which I think wrong. Accusations of this kind may go down well enough with convinced Catholics, but to those who are not so convinced they will suggest that you have no case, and therefore "abuse the plaintiff's attorney."

I could wish that you would confine your moral attacks on me to suggesting that I find self-restraint uncomfortable, and not add that I am a physiologist because of religious impulses. This is like the attitude of the chaplain who, when I was wounded during the war, insisted on labelling me as a member of a religion which I do not profess. I can only retort that I regard morality as a dangerous enemy of religions such as your own, just because for their adherents

the problem of evil is insoluble, and for an evolutionist it is not.

To sum up, I claim to have shown that your faith, whatever may be its foundation, is not based on reason.

I could wish that this correspondence had contained fewer digressions, but I realize that some of them at least were inevitable. Our standards of intellectual valuation are so different that we found it hard to get to grips. But I think that each of us has defended his own views to the best of his ability, and I sincerely hope, as I am sure that you do, that as the result of these letters truth and reason may be helped to prevail both in matters of science and of religion.

Yours sincerely,
J. B. S. HALDANE.

APPENDIX

"ST. THOMAS'S FIVE PROOFS OF THE EXISTENCE OF GOD."

THE existence of God can be proved in five ways.

The first and more manifest way is the argument from motion. It is certain, and evident to our senses, that in the world some things are in motion. Now whatever is in motion is put in motion by another, for nothing can be in motion except it is in potentiality to that towards which it is in motion; whereas a thing moves inasmuch as it is in act. For motion is nothing else than the reduction of something from potentiality to actuality. But nothing can be reduced from potentiality to actuality, except by something in a state of actuality. Thus, that which is actually hot, as fire, makes wood, which is potentially hot, to be actually hot, and thereby moves and changes it. Now it is not possible that the same thing should be at once in actuality and potentiality in the same respect, but only in different respects. For what is actually hot cannot simultaneously be potentially hot; but it is simultaneously potentially cold. It is therefore impossible that in the same respect and in the same way a thing should be both mover and moved, i.e. that it should move itself. Therefore, whatever is in motion must be put in motion by another. If that by which it is put in motion be itself put in motion, then this also must needs be put in motion by another, and that by another again. But this cannot go on to infinity, because then there would be no first mover, and, consequently, no other mover; seeing that subsequent movers move only inasmuch as they are put in motion by the first mover; as the staff moves only because it is put in motion by the hand. Therefore it is necessary to arrive at a first mover, put in motion by no other; and this everyone understands to be God.

The second way is from the nature of the efficient cause. In the world of sense we find there is an order of efficient causes. There is no case known (neither is it, indeed, possible) in which a thing is found to be the efficient cause of itself; for so it would be prior to itself, which is impossible. Now in efficient causes it is not possible to go on to infinity, because in all efficient causes following in order, the first is the cause of the intermediate cause, and the

[1] From the *Summa Theologica*, Part I, Question 2, Article 3.

intermediate is the cause of the ultimate cause, whether the intermediate cause be several, or one only. Now to take away the cause is to take away the effect. Therefore, if there be no first cause among efficient causes, there will be no ultimate, nor any intermediate cause. But if in efficient causes it is possible to go on to infinity, there will be no first efficient cause, neither will there be an ultimate effect, nor any intermediate efficient causes; all of which is plainly false. Therefore it is necessary to admit a first efficient cause, to which everyone gives the name of God.

The third way is taken from possibility and necessity, and runs thus. We find in nature things that are possible to be and not to be, since they are found to be generated, and to corrupt, and, consequently, they are possible to be and not to be. But it is impossible for these always to exist, for that which is possible not to be at some time is not. Therefore, if everything is possible not to be, then at one time there could have been nothing in existence. Now if this were true, even now there would be nothing in existence, because that which does not exist only begins to exist by something already existing. Therefore, if at one time nothing was in existence, it would have been impossible for anything to have begun to exist; and thus even now nothing would be in existence—which is absurd. Therefore, not all beings are merely possible, but there must exist something the existence of which is necessary. But every necessary thing either has its necessity caused by another, or not. Now it is impossible to go on to infinity in necessary things which have their necessity caused by another, as has been already proved in regard to efficient causes. Therefore we cannot but postulate the existence of some being having of itself its own necessity, and not receiving it from another, but rather causing in others their necessity. This all men speak of as God.

The fourth way is taken from the gradation to be found in things. Among beings there are some more and some less good, true, noble, and the like. But "more" and "less" are predicated of different things, according as they resemble in their different ways something which is the maximum, as a thing is said to be hotter according as it more nearly resembles that which is hottest; so that there is something which is truest, something best, something noblest, and, consequently, something which is uttermost being; for those things that are greatest in truth are greatest in being, as it is written in *Metaph.* ii. Now the maximum in any genus is the cause of all in that genus; as fire, which is the maximum of heat, is the cause of all hot things. Therefore there must also be something which is to all beings the cause of their being, goodness, and every other perfection; and this we call God.

The fifth way is taken from the governance of the world. We see that things which lack intelligence, such as natural bodies, act for an end, and this is evident from their acting always, or nearly always, in the same way, so as to obtain the best result. Hence it is plain that not fortuitously, but designedly, do they achieve their end. Now whatever lacks intelligence cannot move towards an end, unless it be directed by some being endowed with knowledge and intelligence; as the arrow is shot to its mark by the archer. Therefore some intelligent being exists by whom all natural things are directed to their end; and this being we call God.

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